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Who Shapes Climate Action in India? Insights from the Wind and Solar Energy Sectors

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List of Abbreviations

AD	Accelerated depreciation
BOT	Build-Operate-Transfer
CDM	Clean Development Mechanism
CEA	Central Electricity Authority
CER	certified emission reduction
CERC	Central Electricity Regulatory Commission
CSE	Centre for Science and Environment
CSP	Concentrated solar power
DANIDA	Danish International Development Agency
DCR	Domestic Content Requirement
DHI	Department of Heavy Industry
DNES	Department of Non-Conventional Energy Sources
EIWEN	EU India Wind Energy Network
EPC	Engineering, Procurement and Construction
Ex-Im	Export-Import
FDI	Foreign Direct Investment
GBI	Generation-Based Incentive
GDP	Gross Domestic Product
GE	General Electric
GEDA	Gujarat Energy Development Agency
IEA	International Energy Agency
INR	Indian rupee
IPCC	Intergovernmental Panel on Climate Change
IPP	Independent Power Producer
IREDA	Indian Renewable Energy Development Agency
IWTMA	Indian Wind Turbine Manufacturers' Association
JNNSM	Jawaharlal Nehru National Solar Mission
JSIR	Journal of Scientific & Industrial Research
JV	Joint Venture
MERC	Maharashtra Electricity Regulatory Commission
MNRE	Ministry of New and Renewable Energy
MoEF	Ministry of Environment and Forests
MoP	Ministry of Power
MoU	Memorandum of Understanding
MW	Megawatt
NAPCC	National Action Plan on Climate Change
NEG	Nordtank Energy Group
NFBC	Non-Banking Financial Company
NGO	non-governmental organisation
NSM	National Solar Mission
NTPC	National Thermal Power Corporation
NVVN	NTPC Vidyut Vyapar Nigam
PM	Prime Minister
PMO	Prime Minister's Office
PPA	Power Purchase Agreement
ppm	Parts per million
PSU	Public Sector Undertaking
PV	photovoltaic
RBI	Reserve Bank of India
RE	renewable energy
REC	Renewable Energy Certificate

RGGVY	Rajiv Gandhi Grameen Vidyutikaran Yojna
RPO	Renewable Purchase Obligations
RPS	Renewable Portfolio Standard/Renewable Purchase Standard
SECI	Solar Energy Corporation of India
SERC	State Electricity Regulatory Commission
T&D	Transmission and distribution
TERI	The Energy and Resources Institute
TNC	Transnational Corporation
TNERC	Tamil Nadu Electricity Regulatory Commission
UNEP	United Nations Environment Programme
UNFCCC	UN Framework Convention on Climate Change
VGF	Viability-gap funding

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1 Introduction

The years since the UN Framework Convention on Climate Change (UNFCCC) was signed in 1992 have been marked by rising concern about the climate problem, given that emissions have continued to rise and atmospheric concentrations have continued to build up to a level where the likelihood of avoiding dangerous climate change – a key objective of the UNFCCC – is diminishing. In fact, atmospheric carbon dioxide levels recently crossed the 400 ppm mark for the first time in human history.[1] At the same time, the UNEP Emissions Gap Report 2012 (UNEP 2012) has highlighted the large gap between the national mitigation pledges in the Copenhagen Accord and the level of reductions that are required for a 'likely' chance of staying below the 2°C target; according to other analysts, these combined mitigation pledges – '[are] consistent with a global temperature rise of greater than 2°C – and possibly as much as 5°C' (Kartha and Erickson 2011).

In some sense, this is not a surprise. The climate change challenge is rendered extraordinarily complex by a confluence of issues. Nations bear differentiated responsibilities for climate change and the nature of impacts is such that some of the worst suffering nations may bear little responsibility for it. Activities that lead to greenhouse gas emission involve pretty much all aspects of the economy – and therefore so will mitigation actions – and adaptation to a changed climate will also require a plethora of activities in various sectors. Moreover, there exist significant differences in the technical, financial, human and institutional capacities of nations to tackle these challenges (Prins and Rayner 2007; Sagar *et al*. 2005). The massive resource mobilisation required for fixing the problem – the IEA estimates that achieving the 2°C scenario would require US$36 trillion more in investments from 2012 to 2050 as compared to a business-as-usual scenario (see ETP 2012) – coupled with the competitiveness concerns emerging from the technological transition that will be necessary to address the climate challenge, further adds to the seeming intractability of the problem.

At the same time, the nature of the discourse in international climate discussions has also evolved. Following the signing of the UNFCCC, most discussions, and the hitherto limited agreements, focused on a top-down commitments-based approach, with the seeming assumption that international commitments would automatically translate into domestic level action. For most of the period since 1992, the approach was to attack the problem – 'directly through global emissions controls, treating tonnes of carbon dioxide like stockpiles of nuclear weapons to be reduced via mutually verifiable targets and timetables' (Prins and Rayner 2007). But the UNFCCC-envisaged international governance of climate change with global policy strategies has not really taken shape in the past two decades. Instead, we have a complex and fragmented set of actions involving several country-level and regional climate change fora (Rabe 2007; Karlsson-Vinkhuyzen *et al*. 2013), termed as the 'regime-complex' for climate change (Keohane and Victor 2010). Interestingly, this 'global federalism of climate policy' has comprised bottom-up actions of not just countries, but also regions and individual firms (Victor *et al*. 2005) as well as the wide ranging and expanding gamut of international organisations engaged in climate change mitigation governance (Abbott 2011).

Whether this kind of bottom-up 'global federalism' will lead to actions to adequately address the climate problem remains to be seen. Existing actions and future national pledges put us on a trajectory that may lead to a global mean temperature rise well outside the currently agreed upon target of 2°C (and the target may itself need to be revised downwards, as some climate scientists suggest (Hansen *et al*. 2013)). Furthermore, progress on adaptation has been even more woeful even as weather patterns consistent with a changing climate manifest themselves across the globe.

[1] See http://scrippsco2.ucsd.edu/data/in_situ_co2/monthly_mlo.csv.

These concerns notwithstanding, the present state and nature of climate mitigation efforts – with the locus of action at the national and sub-national level – underlines the importance of understanding what is shaping climate action within countries. Moreover, such an exploration of the political economy of climate action in a developing country context also has embedded within it issues of justice, effectiveness and of managing the perceived tensions between climate protection and development in developing countries. Several interesting sub-questions emerge: Who are the most powerful actors that shape climate action? What are their motivations? What narratives have shaped the domestic debate (and action) on climate change mitigation? How have the interest group alignments and influences evolved over time?

These kinds of questions are relevant and important, given that developing countries are moving ahead with climate action, even as they continue to focus on addressing urgent developmental challenges. In part, this seems to be driven by the recognition among many of these countries of the potential impacts that they may suffer from climate change; at the same time, there is also increasing international pressure – not just from Annex-I countries but also many smaller and highly vulnerable developing nations – on countries such as China and India that have large and increasing emissions, to take on mitigation commitments (Rong 2010; Rai and Victor 2009). At the same time, climate action is determined not just by the international obligations (or expectations), but also by the domestic institutional capacity, technological standing and imperatives of the policymakers (Rabe 2007; Atteridge *et al*. 2012).

As a result, as opposed to a standard domestic policy problem where mostly the domestic context and domestic actors shape the agenda, climate change turns out to be a problem that has domestic as well as international dimensions that intersect in complex ways. Furthermore, given the fact that climate change actually covers numerous sectors and economic activity areas, there is a host of stakeholders trying to shape the agenda. The sheer number of actors – multiple government agencies, civil society organisations, firms and industry associations, bilateral and multilateral bodies, and so forth – involved in the agenda setting and policy formulation process makes the study of the political economy that shapes such processes quite complex (Hoysala *et al*. 2013).

Several scholars have attempted to unpack and understand these influences in developing countries, providing insights into the role played by actors (Hofem and Heilmann 2013), spatiality of the policy process (Fischer 2012), the actor networks (Never 2012), policy approaches (Harrison and Kostka 2012) and most importantly, the policy objectives beyond climate change mitigation that shape domestic policymakers' response to climate-relevant policies (Atteridge *et al*. 2012).

Within the Indian context, the economic development imperative represents a key set of domestic concerns *vis-à-vis* climate change mitigation action. But climate change poses huge projected impacts across water resources, agriculture, forests, coastal zones, and so on, with particular worrisome implications for the extremely large (~700 million) population dependent on agriculture, forests and fisheries. Hence, as highlighted by Sathaye *et al*. (2006), there exist multiple reasons for India to be concerned about climate change and its link to domestic issues such as energy security and access. This, combined with the kind of international pressure mentioned earlier, has led to an evolution of India's negotiating position (Dubash 2009) to one that, while still embedded in the poor, developing country framework, is increasingly being forced to address the large and rapidly growing emissions from its economy within international negotiations (Dubash 2013). Yet, it is not clear that the relatively limited capability of India to perform, and respond to, analyses that help shape appropriately national priorities and actions (Kandlikar and Sagar 1999) has been strengthened adequately. Therefore, questions pertaining to the 'who' and 'why' of climate action become particularly salient.

Within this paper, we specifically take an actor-centred perspective – focusing on players not just within the government but also private sector and civil society – to better understand the influence of such actors in shaping climate change action within India. Through this analysis, we aim to explore the underlying domestic political economy as well as the international linkages shaping climate action.

We focus on the wind and solar sectors for two reasons: firstly, renewable energy is seen as a potentially important part of the energy mix in a carbon-constrained world and therefore we expect these sectors to become greater loci of climate action in coming years; and secondly, there has been a remarkable activity in these sectors in recent years, thereby providing rich terrain to mine for insights on the kinds of questions that were outlined previously.

These case studies reflect a reasonably complete picture, albeit with exceptions that are pointed out within the paper, of the Indian renewable energy sector both in terms of the actor groups as well as mechanisms of policy intervention. As a result, the lessons drawn from these case studies are expected to closely reflect the learning offered by the paradigm under consideration. While the case study method, like all social sciences research methods, calls for methodological trade-offs, it is useful in providing a good understanding of a complex issue while contributing to experiential knowledge of the subject (Flyvbjerg 2001). The paper looks at inferences, derived from documentary analysis and key informant interviews, that are descriptive rather than causal while adopting an exploratory rather than confirmatory approach; thus adhering to the methodological considerations for case studies proposed by Gerring (2004).

Following the two sector case studies, we add to our actor-centric findings by highlighting the observable key policy narratives used by political agents to frame their positions. Narratives, drawing from the conceptualisation put forth by Jameson (1989), are the constructs that present or re-present factual matter interpreted in a particular manner – and are used to define the policy problem itself and various dimensions of the solutions such as relevant action and responsibilities. As such, these are discursive elements in the policy process and are reflective of aspects of the wider structural context, the motivations of the actors involved, institutions and political formations (see Clegg 1989; Hajer 1993). Keeping in mind the objective of providing a rapid political economy diagnosis, this paper uses this construct to highlight the key discourses and perceptions influencing renewable energy policy insofar as relevant to the central question of who shapes climate policy in India (and its corollaries).

The paper consists of five sections. To aid a more informed discussion in the following sections, Section 2 provides a quick overview of the Indian context within which our sectoral stories (and their actors) are embedded. In Sections 3 and 4, we analyse the policies and agents, as well as the primary narratives within the wind and solar sectors (respectively) with the aim of providing an answer to the primary question of who shapes climate change mitigation action in India (and its corollaries). We conclude in Section 5, distilling our analysis into some broad findings on the political economy of climate change mitigation action in India.

2 The Indian context

2.1 Climate policy in India: a matter of integration

International dialogue on climate change began in the late 1980s, culminating in 1992 with the signing and establishment of the United Nations Framework Convention on Climate Change. India had been a key participant in the negotiations from the onset, ensuring that the responsibilities of various nations in addressing climate change be designated in accordance with historical emissions and the need for the then industrialising countries to grow. Thus, the principal of common but differentiated responsibility, a cornerstone of the position of the G-77 and China in the UNFCCC negotiations, was established.

However, despite its active participation and stand in international negotiations India lacked a domestic policy on climate change. The first attempt at formulating an organised strategy for climate change action in India was the formation of the Prime Minister's Council on Climate Change in 2007. The interests of key government and non-government representatives, rather than institutional interests drove the formation of this council to a large extent.[2] Thus, the council was an outcome of a few realising the need for India to show domestic action in order to maintain its position in international negotiations and strive to achieve its development growth while aiming at improving emission intensity. This council outlined the roadmap for India's action on climate change, namely the National Action Plan on Climate Change (NAPCC), released in 2008.

Following this, climate change mitigation[3] has been integrated into several existing government institutional frameworks such as those directed at renewable energy, energy efficiency, forestry, etc. This contrasts with the approach where countries initiate actions based solely (or primarily targeted) around climate change mitigation concerns. This integration is manifested in the cases of renewable and energy efficiency programmes where the initial reports (pre-2007–08) of electricity generated or saved through the programmes are now supplemented by CO_2 emissions mitigated through the activities within the programme. Thus the loosely-constituted NAPCC incorporated a set of activities (promoting renewables, enhancing energy efficiency and forestry and so forth) that were already taking place in any case due to existing concerns. Thus, it points to the perception that climate change mitigation may only be a co-benefit to other primary concerns in India.

The issue of domestic accountability is also obfuscated due to the structure of India's climate change related actions. The Ministry of Environment and Forests has been the nodal agency responsible for Indian missions to the climate change negotiations. However, it is not in charge of monitoring the climate change mitigation and adaptation measures being carried out under the NAPCC. It can be inferred that climate change actions are not a mandate or responsibility accountable to any one person or nodal agency. The closest one comes to an accountable policy or strategy is the implementation of the missions outlined under the NAPCC. That said, the council does not have the power to hold accountable the nodal ministries for the missions under the NAPCC.

The renewable energy sector in India has grown and developed as an energy security measure for the country, predating climate change mitigation concerns. In the 1980s when the country embarked on its first renewable energy initiative, that is, wind energy demonstration programmes, it was in direct response to the 1970s oil crisis and India's endeavour to become energy self-sufficient. In the early 1990s as India's wind industry grew

[2] Discussions with senior ex-bureaucrat from the MNRE (November 2012) and senior bureaucrat in the MoP (May 2013).
[3] While efforts towards climate change adaptation have also begun, action on this front, as well as the integration of this concern within institutional frameworks, has been somewhat limited (http://cdkn.org/2013/07/opinion-where-twain-shall-meet-drm-and-climate-adaptation-in-india/).

and provided an important player to the global wind economy (Suzlon), regulatory and fiscal policy of the sector attained a better shape with the Department of Non-Conventional Energy's guidelines and the creation of the Indian Renewable Energy Development Agency. The aim of these policies was to create a market-driven self-sustaining sector to aid in India's acute energy shortage. The additional benefit of accelerated depreciation further incentivised India's growing industrial sector to invest in renewable energy, particularly to meet their own energy needs (with captive power), in view of the growing power deficit within the country.

Renewable energy in India has thus been historically de-linked from environmental policy, specifically, climate change policy. The mandate of the MNRE addresses energy security, access, affordability and equity without emphasis on climate change mitigation. Until 2007, renewable energy did not have a stated role to play with regard to climate change policy in India. The NAPCC was the first policy instrument under which the Ministry of Environment and Forests (MoEF) and MNRE were brought together with the shared goal of climate change mitigation. Thus from a political economy perspective it is important to understand that while any renewable deployment in India does contribute to climate change mitigation, these mitigation concerns don't constitute a major share of the driving interests for the policymakers or businesses involved in the renewable sector but are merely a co-benefit. This in itself necessitates a rethink of climate change mitigation as being derived from rather than driving renewable deployment in India.

2.2 Indian polity

India is a federal republic with a parliamentary system of government and a division of legislative powers between the federal (central) government and the state governments. While the balance of power between the states and central government varies with time and context, the degree of cooperation between the centre and the state governments also varies depending on the ruling political parties at these levels. Pertinent to this paper, *electricity* is formally within the concurrent list of subjects on which both the centre and state are permitted to make laws under the constitution of India.

The central government consists of a number of ministries with different executive purview. A central planning body, the Planning Commission, is responsible for laying out the five-year plans that outline the focus for the period in terms of priorities and targets. Within ministries, there are some 'veto-players' such as the Ministry of Finance as well as important players in the context of energy, such as the Ministry of Power and the Department of Heavy Industries. Additionally, there are ministries with specific purviews such as the MNRE and the MoEF. The various ministries have their objectives and agendas and legislation, as well as implementation within any inter-ministerial area (such as the case of renewable energy), requires a significant amount of political manoeuvring on the part of the bureaucrats involved.

2.3 Indian economy

Following liberalisation in the early 1990s, the Indian economy has grown impressively, more so within the past decade. Within this growth trajectory, while the services sector took off impressively, the share of the manufacturing sector as a percentage of GDP has indeed decreased in the past two decades. That said, there are even broader questions raised about the growth during the past decade having been largely a 'jobless growth', especially within the manufacturing and industry sectors. This services-led growth in GDP, is a source of angst among policymakers due to the lower employment generation potential of the services sector. In the early 1990s, it was assumed that the introduction of a free market economy would automatically translate into a thriving manufacturing sector, generating jobs to employ the growing youth population within the country. This has failed to materialise. Notwithstanding the lack of any formal industrialisation policy in India, these concerns have led to the integration of an industrialisation motive within policy decisions.

At the same time, the past two decades have seen strong private players emerging across a range of manufacturing sectors such as automobiles, heavy machinery, pharmaceuticals, wind energy, and so forth. However, the lack of any concerted industrialisation policy and a tardy policy support even within priority sectors, has bred the perception that Indian businesses have thrived not due to, but despite, Indian policies. Adding to this perception has been the failure of the government to provide for the growing power needs of the Indian economy. The peak deficit of the national electricity grid routinely crosses 10 per cent, despite almost a quarter of the country (in population terms) not being electrified,[4] thus making power generation yet another crucial policy priority.

A combination of these factors has led to the emergence of an implicit priority for industrialisation within the country to supplement services-led growth and create jobs. Interestingly, while some recent policies have aimed at generating strategic assets within emerging sectors with a view to future industrialisation and competitiveness (case in point: missions on electric vehicles and solar power), broader issues around enabling industrialisation are yet to be resolved. Dated labour laws, complex land/resource acquisition processes and power availability, along with the high cost of financing are some of the pressing issues that bog down Indian private sector investments. Among these, the cost of financing issue is explained further due to its close impact on the renewables sector.

A common factor impeding capital investments within India is the high cost of financing in the Indian market. With interest rates over 15 per cent prevalent for the financing of project developments (and even higher for renewable projects owing to the higher risks in the renewables sector), such developments are often financially unattractive using Indian financing. Despite high interest rates often being cited as major deterrents to domestic investment in new capacity (across most industrial sectors), policymakers are reluctant to reduce interest rates (and bring them closer to the much lower rates in countries such as the US, UK, Japan, China, etc.). This reluctance stems from the inflationary impact any fiscal or monetary loosening would have on the large constituency of poor people in the country. It is instructive to note that unlike some other emerging nations, only a very minor fraction of workers in India are protected against inflation (through cost of living adjustments to wages). As a result, the high cost of financing is likely to remain an important structural characteristic of the Indian economy in the near future, thereby affecting the actions of stakeholders within capital-intensive sectors such as renewables.

2.4 Indian power sector

An average Indian household consumed 879.22 KWh of electricity in 2011–12 with over 300 million individuals still isolated from the electricity grid. Moreover, with a peak electricity shortage of almost 16.6 per cent (in the southern grid) and poor grid resilience, despite no electricity access for a quarter of the population, electricity, for sure, is a critically short commodity in India. Remarkably, despite a long history of power shortages, the peak electricity shortage is growing due to the increase in demand far outstripping the generation capacity addition and phenomenally high transmission and distribution (T&D) losses (~25 per cent).[5] The present generation mix is dominated by coal power installations (~70 per cent generation) with renewables constituting only 5–6 per cent to Indian power generation (during 2012–13). That said, given the electricity crunch in the country, ample opportunities exist for renewable power to be generated and sold.

Globally, renewables are seen as an important climate change mitigation wedge, with a recent IPCC special report highlighting their potential contribution towards ‘social and economic development, energy access, secure energy supply, climate change mitigation,

[4] www.cea.nic.in/reports/monthly/executive_rep/jan13/jan13.pdf.
[5]Power consumption, peak shortage and T&D losses data source: www.cea.nic.in/reports/monthly/executive_rep/jan13/jan13.pdf.

and the reduction of negative environmental and health impacts'(IPCC 2011). However, unlike some other technologies that are geared primarily towards climate change mitigation, renewables have historically been developed for and are seen in the long term as providers of sustainable energy. In the case of India, renewables were initially seen as additional sources of energy in a power starved nation and have been promoted to various degrees over the past three decades. More recently, due to a number of factors highlighted in the following sections, the deployment of renewables has increased significantly with most of the contribution coming in the wind and solar sector – the sectors under study in this paper. The next two sections show how various stakeholders and narratives have shaped the policies for, and evolution of, these two sectors.

3 Wind power

Wind power in India evolved in the early 1980s from the overarching considerations of energy security (which remains a dominant narrative even today) and is the country's oldest renewable energy sector apart from hydropower. It is now one of the world's largest wind markets and houses a number of prominent international and domestic firms. Over the course of over thirty years the politico-economic ecosystem of this sector has been shaped by a variety of factors and both the policy approach and framework have undergone significant revisions. Thanks to its long history and the engagement of a variety of stakeholders, an exploration of this sector is highly illustrative of the shifting roles and motivations of various actors, the importance of international links and larger considerations of the economy and climate change, among other factors, in shaping policy. The following sections provide an overview of the sector's evolution, the interests and capacities of various actors in policy-shaping processes and finally, the outcomes.

3.1 Wind power sector in India – a snapshot of the present

Wind power policy in India follows a two-level framework, with the MNRE playing a central role in extending two major incentives, a federal tax break and a generation-based premium. The policy paradigm at the federal level is heavily geared towards deployment, either for captive consumption or for sale to the grid and has little focus on R&D, and only marginal focus on manufacturing. Guided by outlines framed at the federal level, the state-level policies, also focused on deployment, play an important complementary role. They extend 'cornerstone' instruments such as feed-in tariffs (or buy-back arrangements) and supporting measures such as 'wheeling', 'banking' and 'open access',[6] which vary significantly from one state to another in terms of implementation. Other important de-risking initiatives that states have pursued include providing speedy access to land and/or technical assistance for resource assessments, which is headed by the Centre for Wind Energy Technology. At the state level, legislative powers rest with the State Energy Department or ministry and the State Nodal Agency, which also deals with disbursal of resources and permits/licensing. The two-tiered structure also extends to the regulatory functions, where the Central Electricity Authority and Central Electricity Regulatory Commission fall under the administration of the Ministry of Power (MoP). The former is concerned with evacuation, grid codes, electricity supply to consumers, planning and metering. The latter, along with the State Electricity Regulatory Commissions deal with tariff regulation, inter-state transmission, licensing and information. The State Electricity Regulatory Commissions (SERCs) are bound by law to make provisions to promote renewable energy in the state's energy mix. Overall, while the MNRE and its supporting agencies are concerned with the deployment and supply side, the MoP and associated agencies are responsible for power generated and demand-side integration.

The current institutional and policy framework is a result of a set of sweeping reforms across the power sector post-liberalisation, listed in the Electricity Act of 2003 and spearheaded by the MoP. Section 86(1)(e) of the Act mandated the creation of the National Electricity Policy (2005) and National Tariff Policy (2006), which in turn created a space for renewables in the power scenario. These two policies are revised frequently and deal with the sale of renewable power, the responsibilities of the state-level bodies in promoting renewables and other supporting measures. An important provision was of renewable purchase obligations (RPOs), which created a niche for wind power to expand into. More recently, an alternative

[6] These policies are somewhat unique to the Indian market. 'Wheeling' refers to the provision that power produced at one location can be transported to the consumer at another location across multiple sections of the grid for a small charge. 'Banking' refers to the provision that allows power produced by wind farms to be fed into the grid and an equivalent amount of power to be withdrawn later at a nominal charge. 'Open Access' refers to the provision that allows consumers to buy power from the open market.

market has been attempted with the creation of renewable energy certificates (RECs), which utilise a cap-and-trade mechanism similar to Europe's Emissions Trading Scheme. Though the REC market has found significant problems in implementation, the importance of this act in creating market predictability and inspiring investor confidence since 2003 cannot be overstated.

Table W-1 State-level incentives for wind energy developers

State	Wheeling[a]	Banking[b]	Buy-back[c]	RPS[d]	Others
Andhra Pradesh	5% of energy	Not Allowed	INR 3.5/kWh frozen for 10 years	–	Industry status granted
Haryana	2% of energy	Allowed	INR 4.08/kWh with escalation	–	
Karnataka	5% of energy	2% per month for 12 months	INR 3.40/kWh fixed for 10 years	3%	Exemption from electricity duty
Madhya Pradesh	2% of energy + charges	Allowed	INR 4.03/kWh, reducing @ INR 0.17 per year	–	Exemption from electricity duty
West Bengal	INR 0.3/kWh (may be revised)	6 months	To be decided on case-by-case basis	–	
Maharashtra	2% of energy + charges	12 months	INR 3.50/kWh with escalation clause	–	Subsidy for power evacuation management
Rajasthan	10% of energy	3 months	INR 3.67–3.71/kWh	–	Exemption from electricity duty
Tamil Nadu	5% of energy	12 months	INR 2.90/kWh	–	
Gujarat	4% of energy	Monthly settlement	INR 3.37/kWh fixed for 20 years	–	Exemption from electricity duty
Kerala	5% of energy	9 months	INR 3.14/kWh for 20 years	–	
Punjab	2% of energy	Allowed	INR 3.66/kWh with five annual escalations	–	

Source: Ex-Im Bank of India (2011). Notes: [a] Wheeling: Charges imposed on entities using power for captive consumption at their sites routed through the state grid. [b] Banking: Storage of power generated by producers with the state electricity agencies which may be drawn for future use. [c] Buy-back guarantee from state grids for purchase of wind power generated. [d] Renewable Portfolio Standard (RPS): State utilities have to purchase a certain portion of their energy from green sources.

Indeed, as the wind sector expanded rapidly after the introduction of the Electricity Act, the market expanded across the value chain, particularly in manufacturing. India is now host to a number of well-known international firms and is also home to a number of local firms including Suzlon, which has historically dominated the local market and is India's 'champion' in the global wind industry. These firms exert a significant amount of influence both through their local presence across many states, thanks to their extended supply and service chains, and also at the centre through powerful manufacturers' associations. These organisations play a large part in deliberation, policy agenda setting and formulation through their lobbying activities and do much to engage with public and civic stakeholders. To a much smaller extent, Engineering, Procurement and Construction (EPC) companies and various smaller financiers, both public and private, also exert some influence at the state level though their role is limited to deliberation.

International agencies that played an important part in the early stages of the sector still play some part in technical assistance, though their role in policy framing is extremely limited. Additionally, financing for wind power has also seen significant evolution. Whereas the role of international donor agencies, multilateral agencies and development banks in financing was pivotal in building financial capacity (including the seeding of the Indian Renewable Energy Development Agency) and extending affordable credit lines, this has declined over the years. Now, finance is primarily secured from private and public sector banks and infrastructure funds and NBFCs. Capital markets, corporate bond markets and other derivative markets,

however, remain underdeveloped but equity funds now look to add wind projects to their portfolios.

Table W-2 Tax breaks given to wind energy component manufacturers

Indirect taxes		
1.	Wind-operated electricity generators up to 30 kW and wind-operated battery chargers up to 30 kW	5%
2.	Parts of wind-operated electricity generators for manufacturers of wind-operated electricity generators:	
	a. Special bearing	5%
	b. Gear box	5%
	c. Yaw components	5%
	d. Wind turbine controllers	5%
	e. Parts of goods specified at (a) to (d) above	5%
	f. Sensor	25%
	g. Brake hydraulics	25%
	h. Flexible coupling	25%
	i. Brake callipers	25%
3.	Blades for rotor of wind-operated electricity generators for the manufacturers or the manufacturers of wind-operated electricity generators	5%
4.	Raw materials for manufacturer of blades for rotor of wind-operated electricity generators	5%
5.	Customs duty on permanent magnets for wind-operated electricity generators	5%
Direct taxes		
1.	80% accelerated depreciation on specified renewable energy devices/systems (repealed in 2012)	
2.	Tax holidays on power projects	
3.	Incentive of Rs. 0.50 per unit of electricity fed into the grid is provided for a period not less than four years and a maximum period of ten years with a cap of Rs. 62 lakhs per MW (this scheme is currently awaiting renewal).	

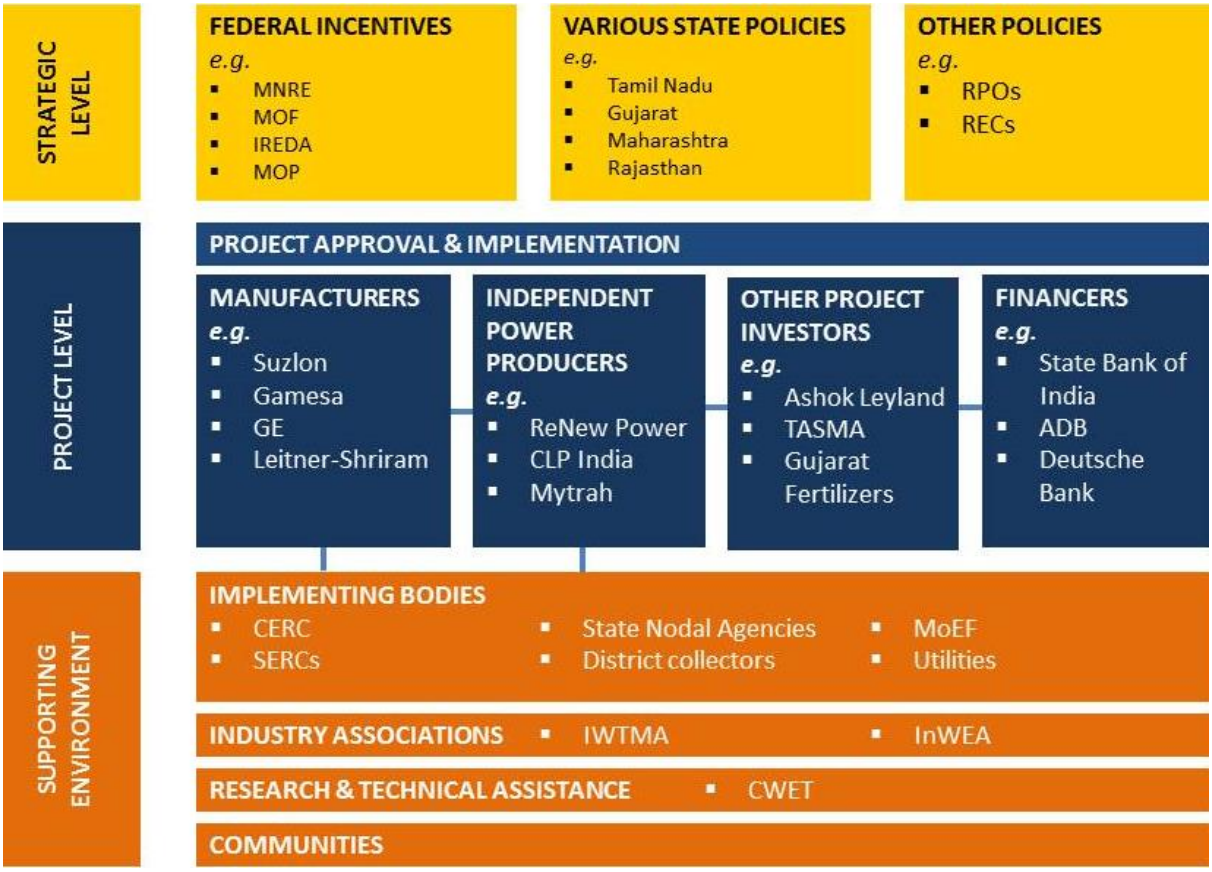
Source: Adapted from Indian Wind Power Association (2011).

Project investors in wind power, historically, have been firms looking to drive down their fuel costs, avoid paying high commercial power tariffs and hedge against erratic power supply. Many investors, particularly large conglomerates or high revenue firms, looked to wind power as an effective tax saving asset. As the sector progressed, sale of power to the grid has also become more important and now, independent power producers also hold a large (and growing) share of the market. Their growth has been greatly facilitated by developments in technology brought in by foreign manufacturing firms and performance-based incentives that vastly improve the business case for grid-fed wind power. Other actors, such as some prominent NGOs like the Centre for Science & Environment, the Energy Resources Institute, the World Institute for Sustainable Energy and the Shakti Foundation have played an important role in technical information gathering and dissemination and sector assessments, thus indirectly shaping the policy agenda, and to some extent, flagging important issues in stakeholder meetings.

Primarily, whereas institutional motivations pervade the sector, energy security (especially at the state level) has been a dominant theme. Also, the gap between energy supply and demand in India is still so great that wind does not directly compete with conventional forms of power. Climate change is also a marginal, but increasingly important narrative, which was introduced with the Clean Development Mechanism (CDM) and is gaining prominence with India's climate change mitigation aspirations. From the private sector perspective, for project investors, returns on investment are the primary consideration, as it may be for the manufacturers. The latter, however, also wish to expand and diversify the market as much as possible, and due to their sheer scale, grapple with policy implementation problems as well.

The complexity of the situation has increased with IPPs, who, thanks to their growing scale have recently begun to influence the sector and have formed their own associations. They have opposed a recent measure to introduce price discovery in wind power projects (similar to the cornerstone policies in the National Solar Mission, discussed in section 4.1) and appear to be engaging in rent-seeking behaviour by encouraging tariff hikes instead (Ramesh 2013a).

Figure W-1 The ecosystem of wind energy in India



Source: Figure compiled by authors. Data taken from publicly available information from the Ministry of New and Renewable Energy.

What is interesting about wind power is the perception within policymaking circles that the sector is 'mature' and to some degree, self-sustaining. It has never featured in a mission approach nor is it a part of the NAPCC (this is discussed in the Climate Change Narrative sub-section in section 3.3). It is perhaps unsurprising given the indicators in financial markets, investor returns and strength of the manufacturing industry. However, under the recent fiscal tightening and macroeconomic malaise, this perception prompted a revocation of the federally extended accelerated depreciation and generation-based incentive – a move that has severely affected the sector. This is not to say that it has not received concerted attention – the Planning Commission's Five Year Plans have frequently set ambitious targets for wind power (the latest even mentioning the possibility of a wind mission) and many state-level governments, notably Tamil Nadu, have given it prime importance – yet, an overarching framework remains conspicuous in its absence. An examination of the evolution of this sector provides some explanation for why this is so.

3.2 The emergence and evolution of the wind sector in India

The story of wind power policy in India can be explored across three distinct phases – (1) the early stages of agenda identification and sector goal-setting, stakeholder engagement and

learning; (2) a middle period of significant policy reform in the power sector linked with the emergence and growing influence of a manufacturing industry and 'boom' period until the global financial crisis; and (3) a restructuring of the policy approach and goals along with the emergence of newer players and general economic slowdown. Various actors' interests and influence have evolved over these periods and the events offer clues as to the current state of politico-economic equilibrium.

Table W-3 A timeline of key policies

Policy	**Year**	**Actor(s) involved**
Accelerated Depreciation	1992	MNRE, MoF
Tax Holidays	1992	MNRE, MoF
Customs & Excise Duty reliefs	1992	MNRE, MoF
Electricity Regulatory Commissions Act	1998	MoP
Electricity Act	2003	MoP, MNRE
National Electricity Policy	2005	MoP, MNRE
National Tariff Policy	2006	MoP, MNRE
National Action Plan on Climate Change	2008	Prime Minister's Office
CERC Renewable Energy Tariff Order	2009	CERC, MoP, MNRE, SERCs
Generation-Based Incentive	2009	MNRE
Renewable Purchase Obligation	2010	MNRE, MoP, PMO
Renewable Energy Certificates	2010	MNRE, MoP, PMO
Indian electricity grid code	2010	MoP
Unscheduled Interchange code	2012	MoP
State-level policies	Year	Actor(s) involved
Gujarat Wind Policy	1993, 2002, 2007	GEDA
Maharashtra Sales Tax relief	1996	Maharashtra State Govt.
Maharashtra Tariff Order	2003	MERC
Maharashtra Wind Policy	2007	MERC
Tamil Nadu Tariff Order	2009	TNERC

Source: Authors' compilation from various policy documents.

First phase (pre-1999)

As we introduced in the previous section, wind power in India dates back to the global fuel crisis of the 1970s. Heavily dependent on fossil-fuel imports (as it still remains), the Indian polity recognised the threat of the situation and created the Department for Non-Conventional Energy Sources (DNES). This department, later to become the world's first dedicated ministry concerned with the promotion of renewable energy, actively sowed the seeds of this sector by linking with major international bodies. The Danish International Development Agency (DANIDA) and the World Bank aided the DNES in securing appropriate technology, resource assessment and engaging stakeholders through policy sculpting. The Indian Renewable Energy Development Agency, a key node in the ecosystem concerned with the overall assessment of the wind programme and provision of low-cost debt and concessional finance towards renewable energy projects was seeded with the aid of the World Bank and the Asian Development Bank. The Indian Renewable Energy Development Agency (IREDA) would play a seminal role in funding the wind power programme in the coming years. This early phase, led mostly by the DNES, was a period of policymaking focused on building institutional capacity and creating a manufacturing base. One of the first turbines in the country was a Nordex device, which was transferred on the basis of a licensing agreement with Bharat Heavy Electricals Ltd., which set up a manufacturing centre locally.

Looking to engage stakeholders in the industry, the DNES targeted a key concern for industrial consumers of electricity – the price and instability of grid power in India (Planning Commission 2002). Introducing a 100 per cent accelerated depreciation (a result of some negotiation with the Ministry of Finance) on renewable energy assets, the DNES, later renamed the Ministry of Non-Conventional Energy Sources, oversaw a period of capacity building and learning. This period extended up to 1999 when a reduction of the tax benefits, inappropriate technology and poor installation practices caused a considerable slump. The manufacturing firms that survived this period of consolidation were a few robust entities whose technology licences and strong, long-term focus on the sector helped them weather the shakedown (Rajsekhar *et al*. 1999).

When viewed at the state level, the policy story displays another dimension of richness. Mainly due to the high concentration of the wind resource locally, the three states of Maharashtra, Tamil Nadu and Gujarat (and to a lesser extent, Rajasthan, Karnataka and Andhra Pradesh) were in this period poised to take a prime role in the development of this sector. For example, Maharashtra, plagued by a shortage of power for its rapidly growing myriad small and medium enterprises in the mid-1990s, took a leading role in encouraging investors by providing a sales tax concession to manufacturers. The state also offered to extend long-distance transmission facilities and infrastructure to wind power projects. This was a proactive move on the part of the local government and (then) energy ministry. In Tamil Nadu, similarly, a number of sectors including textiles, chemicals and automotive vehicles witnessed a period of rapid growth thanks to a healthy, conducive investment environment, excellent infrastructure and a succession of proactive governments and efficient bureaucracy. Thanks to high power tariffs, these firms preferred to invest in wind while also availing the offered tax benefits and hedging against fuel price volatility linked with diesel generators. The resulting demand was so great for so many years that a number of manufacturers would make Tamil Nadu their base of operations. The government and bureaucracy did react by enabling speedy access to land and infrastructure. Both of these measures in these states – policy as well as regulatory – should be appreciated for the role they played. In contrast, Kerala, a state with excellent wind resources has not seen the level of activity that Maharashtra or Tamil Nadu has seen and installed wind power capacity here is negligible after so many years. Although there are many factors to this, including the lack of well-developed industry and inefficient bureaucracy, (see Benecke 2011) the lack of supportive policy or regulatory action is stark. This serves to highlight the importance of state-level actors in shaping wind power policy and growth.

Second phase (2000–08)

Apart from the creation of renewables (particularly wind) as a separate space within the power sector, this phase saw the emergence of manufacturers as strong influencers of policy and policy implementation. Whereas efforts were still led by the MNRE, demand-integration issues under the purview of the MoP also began to emerge. The latter part of this period saw the capacity addition focused policy regime come up short in terms of spurring technology and performance, resulting in a series of revisions.

After nearly a decade of growth post-liberalisation, the struggling Indian power sector underwent a series of reforms, beginning with the Electricity Regulatory Commissions Act in 1997 and ending with the Electricity Act of 2003. Although the MoP led this endeavour, the Ministry of New and Renewable Energy played a considerable role in these reforms. Recognising the fact that renewable power would require adequate promotion, the MNRE actively lobbied for the inclusion of supportive measures. The result was a specific ‘niche’ for renewable energy within the country’s power sector along with clear responsibilities for various agencies in the legislative and regulatory machinery. Where the state nodal agencies became key in policy planning and disbursal of resources, the SERCs are responsible for planning, setting minimum renewable purchase obligations, engaging stakeholders and tariff determination. The dynamic between the state governments and these bodies is, however,

complex and state-level ministries may exert some influence over their functioning through appointments, funding, etc.

For this period, energy security concerns and attractive returns on wind power were of paramount importance. The role of the regulator here is important on many fronts: tariff determination for example, previously the purview of the state energy department, now passed to the regulator, and the structure of this instrument became the most vital element in spurring growth. In 2003, when the newly re-structured power sector still carried much uncertainty and perceived risk, the Maharashtra Electricity Regulatory Commission laid out in a study and a seminal tariff order, the principles for tariff determination that are now ubiquitous throughout the country. The regulator's goal was to ensure investment in wind, out of energy sufficiency and security concerns, by providing a market return comparable to other businesses by adopting a 'cost-plus' method and ensuring a levelised structure that was to ensure lock-in as well as suitable cash flows that matched market loan terms.[7] The Forum of Regulators, a pan-India body, became a platform where these principles were discussed and diffused, later adopted and streamlined by the Central Electricity Regulatory Commission (CERC) – thanks in no small part due to the influence of agents from the State Electricity Regulatory Commissions who moved to the CERC. Maharashtra's Electricity Regulatory Commission also came out with India's first Renewable Purchase Standard (RPS), which was again responsible for creating a market clarity that proved invaluable. Indeed, in the successive National Electricity Policy, the idea that states must procure a certain percentage of their power from renewable energy was laid out in principle, and the diffusion of this idea was due to the effort of the regulator as well as the MNRE.

On the ground, as both investors and manufacturers began to grow and expand, the latters' influence on the market and policy also waxed. Many Indian manufacturers entered into Joint Ventures or Licensing Agreements with foreign firms and typically had EPC capabilities to add to their competencies in turbine and component supply. The dominant model was to develop sites, procure land and other resources and sell contracts on a turnkey or BOT[8] basis. Needless to say, the manufacturers also provided operations and maintenance services. Thus, these vertically integrated bodies gained experience and influence quickly across the sector and were instrumental in lobbying for measures to augment infrastructure, improve policy implementation or revise tariff hikes and supporting policies (such as wheeling and buy-back), driven by the profit motive. This period saw the growth of Suzlon into one of the world's top wind turbine manufacturers, though, as its success has yet to be replicated, the firm may be a poor indicator of the general innovation ecosystem (for more details on Suzlon's success, see Vietor and Semineiro 2008). Most of its R&D capabilities and higher-edge technology comes from licensing or acquisition activity abroad (Lewis 2007, 2011). The other prominent firms in this period include NEG Micon, Vestas-RRB, Pioneer Wincon and Enercon. Prominent EPC firms that have built up capabilities in wind turbine supply included Leitner-Shriram and Inox Wind. The JVs and foreign firms, along with Suzlon, dominated the market thanks to their strength in services.

Indeed, thanks to the monopolisation in the market fed by manufacturers' business models, the performance and competitiveness of the industry fell between 2000 and 2006. Whereas costs of wind power worldwide were declining rapidly, in India, they actually grew. Plant Load factors fell and the industry voiced demands for better measures. There was also significant opposition to the expansion of wind power, which came from many utility companies (most of whom are publicly owned), for whom renewables ranked low on the priority list. These cash-strapped bodies vehemently opposed any policy measures mandating additional expenditure for long-distance transmission infrastructure and pointed at the intermittency and unpredictability of wind as a significant drawback and management issue. Their problems

[7] Interviews, former regulator and official at Maharashtra Energy Development Agency.
[8] Build-Operate-Transfer.

were reflective of wider politico-economic issues across the power sector and are beyond the scope of this paper.

While these developments were playing out in the sector, the influence of the larger multilateral and international agencies had begun to wane. Their interest (and influence) in this increasingly firm-driven sector was superseded by more pressing issues of the power sector in general. Their role was now limited to building technical capacity and small R&D projects. IREDA's influence also waned and it saw its prominence as a lender decrease as more commercial banks engaged with the sector to extend balance sheet finance.

Leading up to the events of the financial crisis, wind had begun to settle as a mature sector, but was plagued with problems in infrastructure and technology. The capital-subsidy based rent provisions had skewed the market heavily in favour of manufacturers. At the state level, tariffs became an increasingly important issue and while states such as Gujarat and Maharashtra promptly initiated and implemented measures such as renewable purchase obligations and wind power policies,[9] other states such as Tamil Nadu lagged. There are various explanations for this – proactive states could have been led by strong considerations of energy security, whereas in Tamil Nadu, providing cheap electricity for consumers was an important move to sway political constituents. All these factors, however, did not stop investment from pouring into wind power in India, and in 2008, it saw a record US$2.7 billion in new projects (UNEP-SEFI 2009).

Third phase (2009–present)

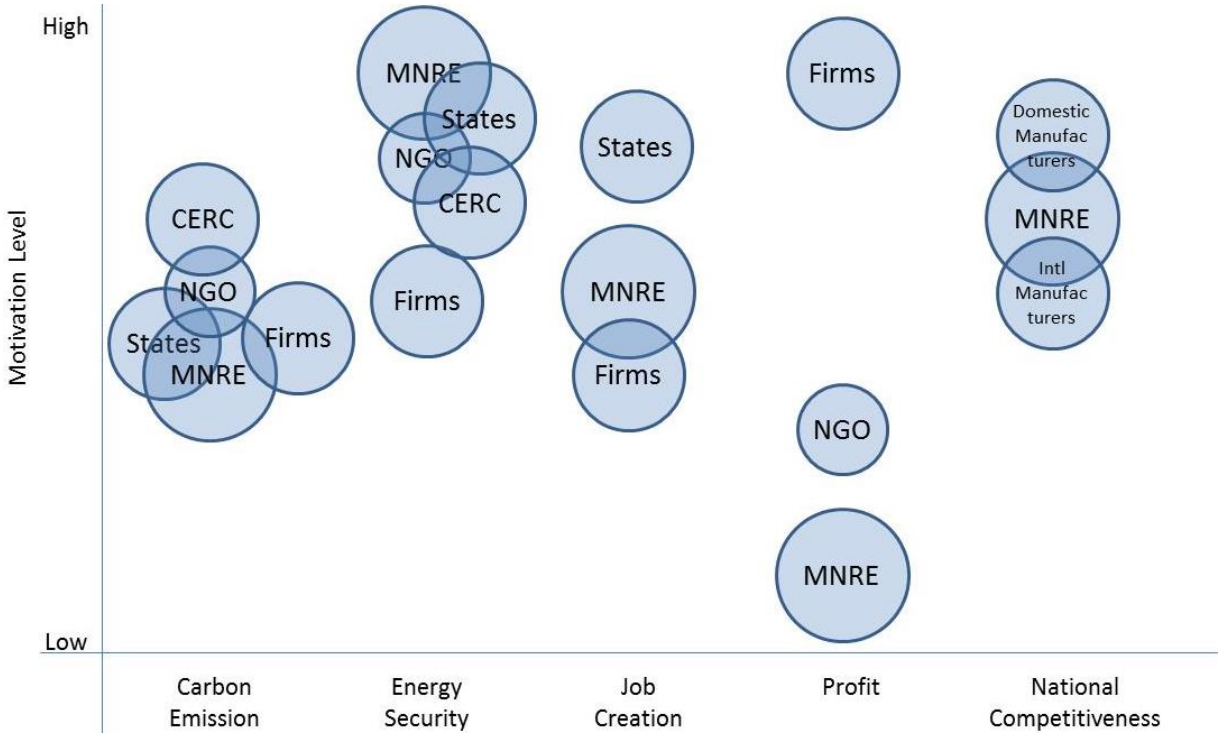
Thanks to the market problems seen in the previous phase, the MNRE saw fit to introduce two important policy approaches. First, a shift to performance-based instruments had become important given the poor generation performance in recent years. The second, which emerged out of deliberations surrounding the NAPCC, was the introduction of state-regulated, firm level renewable purchase obligations and a linked Renewable Energy Certificate trading market. Reforms in the power sector between 2002 and 2006, encouraging FDI and technology transfer had opened the door for large foreign-equity backed independent power producers to enter viable power generation businesses in India. A number of these entities have now targeted the wind power sector for future returns. For these firms, the accelerated depreciation was not an attractive incentive due to their sheer scale of operations and revenue model that relied on selling generated power, unlike the captive producers – and thus, a generation-based incentive was an important introduction. The design itself was a result of stakeholder consultations between this group and the MNRE and has been quite successful in attracting investor interest along with state-level tariffs. The REC market, on the other hand, has seen little participation, though now, investors have begun to see it as a viable market. Whereas some critics have pointed to the lack of political will among regulators to enforce this measure (with some notable exceptions such as Maharashtra and Gujarat), others have pointed to the lack of urgency among 'big industry' groups, such as steel and coal, to adopt these measures in the face of complacent government.

The important shift in the market due to these measures is the emergence of larger wind projects and a performance-focused approach to technology. A number of leading international firms including GE, Vestas and Siemens have now opened R&D centres in India. These firms view global markets in terms of wind class, and so far, there has been little incentive to invest heavily in innovation for India's wind regimes. With performance now taking centre stage, the technology has been subject to pressures to produce and adapt to

[9] Gujarat announced revised policies in 1993, 2002, 2007, 2009 and 2010. A new policy is expected in 2013. Maharashtra announced a leading mix of instruments in 1996 that was revised in 1999. The MERC became a model for other state bodies in 2003 with its enforcement of renewable purchase obligations. It revised its policies again in 2006, 2010 and 2011. Tamil Nadu has revised its policies multiple times (2003, 2005, 2007, 2009, 2010, 2011 and 2012). Tariff increases, however, were made only three times in the last decade.

local conditions. It should be noted that although technology transfer to India in the wind power sector has lagged in the past, it is no longer the case (see Mizuno 2007; Lema and Lema 2012), not least due to the fact that globally, the wind industry is a flat and easy technology access field (also see Lewis 2011). Other firms such as ReGen Powertech have also started competing with established models such as Suzlon's. These newer entrants are gaining a prominent voice among the manufacturers' associations – though their motives towards policy as a whole have not changed, competitiveness, which was so far a muted agenda, is now beginning to emerge. The IPPs have also now begun to influence policy (especially at the central level) in a large way and are also increasingly vocal about tariff regulation at state level – for these entities a stable generation-based revenue is paramount, and thus regular tariff revisions and long-term contracts are the main policy agenda. Many, such as China Light and Power and Mytrah have set extremely ambitious targets and their strategic intent is quite clear.

Figure W-2 Policy motivations for actors in the wind sector and their respective motivations

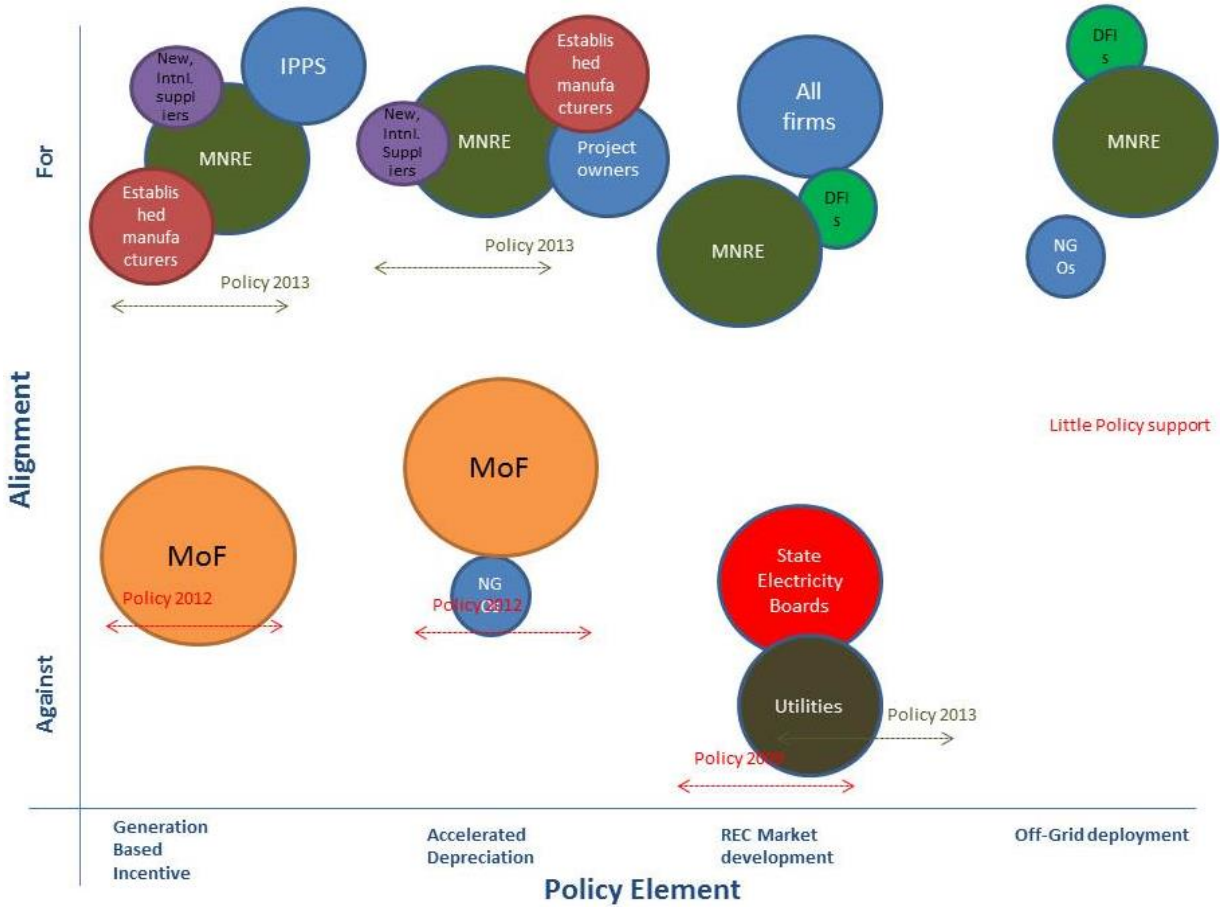


Source: Figure compiled by authors. Export-Import Bank of India (2011). Note: Bigger circle denotes higher influence.

With these developments in mind, those within policymaking circles have now begun to view wind power in a slightly different vein than solar power – wind, with its attractive returns and readily available finance and experienced stakeholders has now become a 'familiar' business. Perhaps due to this, there is a sense of perceived 'maturity' regarding the sector. This is also reflected in the MoP's recent measures to enforce a scheduling grid code on wind power producers, a move welcomed by utilities and also by the industry. However, this has had some perverse effects – the technical business case for wind still relies heavily on subsidies, and in light of the recent slowdown in the Indian economy, the Ministry of Finance saw fit to retract first the accelerated depreciation and then the generation-based incentive. Thanks to significant lobbying by various associations and proactive participation by the MNRE, one of these measures has been restored and the other is likely to follow. This however, did not stop investor confidence from plummeting in 2012 and investment fell by 40 per cent in 2012–13 (Frankfurt School-UNEP Centre/BNEF 2013).

What is encouraging, however, was the announcement in the 12th Draft National Five Year Plan that wind power should be considered a strategic asset for India and may warrant a 'mission' approach in the future.

Figure W-3 Policy positions for actors in the wind sector on various policy elements



Source: Figure compiled by authors. These representations are based on discussions with interviewees across the MNRE, the MoP and the World Bank. Note: Bigger circle denotes higher influence.

3.3 The political economy of the Indian wind sector: key narratives

To appreciate how various actors' interests aligned (or opposed each other, as may be the case) and explore how these policy shifts were influenced, we explore the various narratives in the wind sector around which actors have congregated.

Energy security narrative

As discussed above, the origins of wind power in India are rooted in the concerns of the global fuel crisis of the 1970s. Since then, energy security at the national level and (perhaps more importantly) energy security at the state level have driven the sector forward. The MNRE as an institutional actor has been the most important player in shaping policy and securing resources. Indeed, for many years now, it has been the stability of their agenda for wind that has provided a valuable backbone to wind power policy. The Planning Commission has also given increased weightage to wind power over the years – a fact reflected in the detailed discussions of the sector in its five-year plans. Having said this, the importance of the energy security narrative is also highly visible at the state level of policymaking. As we have already seen, state governments in Gujarat, Tamil Nadu and Maharashtra have been leading players in adopting and creating incentives for investors. It is no surprise that these states host a number of high-growth industries and are also home to high-income entities for whom a secure source of power and tax savings are important. Interestingly, policies both at the central and state level are geared towards the promotion of utility-scale wind power and there is no concrete framework for small-scale off-grid applications (apart from small systems for pump-sets in irrigation and wind-solar hybrids, which are yet to take off). Some experts have pointed to the lack of powerful players in the off-grid segment looking to create a pull for policy action.

Between 2000 and 2005, the case for wind power was made primarily along the lines of providing a stable backup for growing industries. Wind power lends itself particularly amenable to this agenda for two reasons – (a) the resource is fairly well distributed (b) the turnaround times for the development of a wind power project are low as compared to thermal power plants. For politicians at the state level, approving wind power projects is a convenient way to meet incremental demand within the electoral cycle.[10] The addition of thermal generation capacity, on the other hand, is a long process, which requires a long planning period and an even longer construction and commissioning period, requiring forecasts of demand growth; and thus capacity addition takes place only in large quanta increments.

The influence of individual firms at the state level is also significant. Public sector promoters of wind power may seek to gain political prestige and ‘success stories’ by signing widely publicised MoUs with larger wind turbine manufacturers (such as Suzlon) for specific capacity addition targets within the electoral term. The long-term success of such initiatives, however, depends on the particular level of initiative taken by, and independence afforded to, the state nodal agency, electricity boards and the regulatory commissions, as it is these bodies that revise tariffs and solve transmission issues. Evidence of political patronage in some states (such as Tamil Nadu) has coincided with poor incentive structures or sluggish revision of policies. Gujarat, with its efficient bureaucracy has shown strong, predictable policy action in the recent past.

The energy security narrative has also been used by firms (mostly manufacturers) as part of their marketing strategies, but in recent times has evolved to include large independent power producers who seek massive expansions to their portfolios. These entities have sought benefits from a separate set of policy instruments than traditional investors and have now drafted their own association to mirror the IWTMA. Their influence appears to be growing as recent discussions about the generation-based incentive, and proposed plans to increase the cap have shown (Bloomberg 2013).

The overall narrative also appears to be taking another turn in recent years. With the largest installed wind capacity in India, now totalling over 7000 MW and a 40 per cent penetration, wind power in Tamil Nadu has been widely publicised as a resounding success. Since 2009–

[10] There is a similar situation in solar power, which is discussed in the sub-section on state-level policies in section 4.3.

10, however, the situation on the ground has become complicated. Despite the best resource quality in the country, intermittency and seasonality are natural constraints on generated power. This was compensated for in earlier periods by the state's thermal power capacity (Tamil Nadu had been self-sufficient for the better part of 2000–10), and measures such as banking of power and easy grid integration from the perspective of the utilities was feasible. However, the state has since been unable to keep up with demand growth, choosing to rely on wind power rather than add thermal capacity (the central government has made some attempts to solve this problem and placate industries by investing in generation in the state (see Madhavan 2012)). This has caused an adverse situation in the state where residential power supply is being rerouted to industrial consumers, reliance on diesel has increased and wind power projects are facing difficulties in securing permits. With this experience, stakeholders have become more cognisant of the limitations of wind power, and the importance of integrated planning for wind and other sources has begun to emerge. Storage technologies are still considered a distant (though achievable) measure, but for now, the implementation aspect of the energy security narrative followed so far with respect to wind power is being revised.[11]

The scaling up and quality/performance narrative

A related issue with wind power that has been brought up at periodic intervals has been the *performance* of wind farms in terms of total power generated. The re-organisations in the policy approach to wind power have often congregated along issues of poor performance. In 1999, while wider systemic issues (such as difficulties in land acquisition, poor installations and high corporate taxes) de-railed the steady growth through the decade, it became necessary to adopt better technology. Some critics pointed out that wind turbines were 'gold-plated machines' – the higher the cost, the greater the tax shield through mechanisms such as accelerated depreciation measures, with little focus on performance.[12] The policy response in this period worked to strengthen capacity in technical assistance and resulted in the creation of the Centre for Wind Energy Technology, which introduced standards, testing and certification services apart from other technical assistance. IREDA also took a more leading role in sector assessments and programme monitoring.

As the reforms of the Electricity Act took effect, investor confidence in the sector shot up, and with various state governments taking the lead, demand outstripped supply. The focus moved from individual sites and small-scale wind farms to wind estates. On the supply side, until 2007, there were mainly four companies (Suzlon, Enercon, Vestas and RRB Energy) that captured approximately 80 per cent of the market share, with other manufacturers dealing in lower rated turbines. Thanks to this drastic asymmetry, these manufacturers were able to focus on providing services and command higher rents in the market. Their considerable influence as 'voices' of the industry did not fully address the issue of lower plant performance in light of other pressing systemic problems. The project owner would typically have little choice in terms of the technology; neither would these firms always have the capabilities to carry out the erection and commissioning activities (such as constructing roads, transportation, securing local support, etc.) and thus left these risks for the manufacturer to bear – leading to the higher prices that the manufacturers then commanded. As a result, the capital costs of wind power shot up, even as some experts alleged that the performance did not improve significantly (Jamwal and Lakhanpal 2008). Indeed, plant load factors in India have always been low primarily due to the low-speed regime prevalent across the country but the lack of technology implementation focus (particularly at the execution level) for such wind regimes exacerbated the problem.

At the end of this period particularly, studies by notable civil society organisations pointed out that the performance of wind farms developed in high-value areas was much lower than

[11] Findings from the author's observations at the 7th National Renewable Energy India Expo, November 2013, New Delhi.
[12] Interview with former official in the wind industry. See also Rajsekhar *et al*. (1999).

expected. Allegedly, focus on land assets, improper micro-siting and rushed execution were again, leading to sub-optimal outcomes. The former ghosts of 'gold-plated' machines, raised up again, only strengthened the views of some stakeholders (mostly government agents, civil society, some private sector agents) that a performance-based policy instrument was necessary.[13]

In the second half of the decade, policymakers began to recognise this challenge, particularly as the independent power producers voiced their intentions to invest in wind, but raised questions about the bankability of their projects. Financial analysis undertaken by IREDA added weight to their arguments and the MNRE declared the generation-based incentive as an alternative incentive in lieu of the accelerated depreciation mechanism used so far. This measure, though not as successful as originally envisaged, managed to attract a significant swathe of investments alongside revised state-level tariffs.

This movement has been bolstered by the entrance (or growth) of a number of newer wind turbine manufacturers who look to supply turbine technology more suited for IPP operations (i.e. with a higher power rating, better performance in low-wind speed conditions, and which withdraw less power on start-up). This has helped create a market for manufacturers who engage purely in turbine supply and who are focusing on providing performance guarantees. ReGen Powertech, for example, a recent entrant in the manufacturer industry, has already gained a reputation as a leading provider for IPPs and provides such guarantees. GE, Vestas and Siemens have now set up R&D units within the country. Firms in this industry view their global markets not in terms of geographies, but in terms of wind regimes, and now India is developing into a hub for Class II and Class III machines that cater to the lower wind regimes. These newer entrants are gaining significant influence within associations and policy discussions.

Table W-4 Manufacturers offering Class II and Class III turbines in India

Manufacturer	**Technology**				
	Rating (kW)	**Drive**	**Speed**	**Generator**	**Class**
Enercon	800	Gearless	Variable	Synchronous	II-S
GE Wind	1500	Gear	Variable	DFIG	II-A
GE Wind	1600	Gear	Variable	DFIG	II
Suzlon	1250/2100	Gear	Fixed	Asynchronous	II-A/III
Suzlon	1500	Gear	Fixed	Asynchronous	III-A
Suzlon	2250	Gear	Variable	DFIG	II-B
Vestas Energy	1650/1800	Gear	Variable	Asynchronous	II-B/III-A
RRB Energy	1800	Gear	Variable	Asynchronous	II/III
Gamesa	850	Gear	Variable	DFIG	II-A/III-B
Gamesa	2000	Gear	Variable	DFIG	II-A/III-B
Global Wind Power Limited	2500	Gear	Variable	Synchronous	III-A
Inox Wind Limited	2000	Gear	Variable	DFIG	III-B
Kenersys India	2000	Gear	Variable	Synchronous	II-A
Leitner-Shriram	1350/1500	Gearless	Variable	Synchronous	II-A/III-A
ReGen Powertech	1500	Gearless	Variable	Synchronous	III-A/III-B
WinWinD	1000	Gear	Variable	Synchronous	III-B

Source: Global Wind Energy Council (2012).

This policy approach, however, has not stood the test of robustness and in 2012 the Government of India declared that it would withdraw both the accelerated depreciation (AD)

[13] Confirmed in interview with former President, Suzlon and current official at Bureau of Energy Efficiency. See also Jamwal and Lakhanpal (2008), for example.

(along with the introduction of the direct tax code, a larger set of reforms across the Indian financial sector) and the generation-based incentive (GBI). An understanding that wind had reached maturity as a sector and could sustain itself without significant policy support coupled with the focus on capping government funding contributed to this policy action. After a record lull in investment following this decision, significant lobbying efforts, both by the MNRE and all industry interest groups have since managed to convince the government to reinstate the incentives along with calls for specific revisions in the GBI mechanism. While the GBI has been restored, and an announcement made that the AD would also be restored, there has been no announced timeline or action on that front. What this experience points to, however, is that despite the perception of stability and maturity, investors still depend closely on policy measures for market clues and the response to sector maturity must be executed with adequate long-term clarity.

Climate change narrative

As discussed briefly in Sections 3.1 and 3.2, wind energy policy predates the discourse on climate change in India by many years. The origins of the sector were rooted in energy security concerns rather than mitigation action, and unlike the case in developed countries where wind energy is a substitute for conventional forms, in India it remains a supplementary source.

As the climate dialogue evolved on the ground, however, wind power received some amount of indirect attention and influence from other elements engaged in the form of the CDM mechanism and later the RPO mechanism. As the debate matured, and the government's stance on mitigation action shifted from one of defensiveness to action, wind has begun to gain *some* traction as a strategic asset for climate mitigation. The co-benefits narrative particularly has allowed wind to creep into the national interest.

Within the industry, the climate perspective was brought in during the COP8 Conference in New Delhi when the Confederation of Indian Industries recognised the benefits that the Clean Development Mechanism could provide and pushed government negotiators to adopt it. The MoEF has since become the key nodal agency in the country along with the National CDM Authority to monitor and approve of CDM projects. Though the wind industry was not a close or direct influencer of these changes, the industry did derive an important revenue stream from the sale of CER certificates. Between 2003 and 2008, particularly, there was a steady growth of CDM projects before implementation issues reduced the attractiveness of the benefit. The view among policymakers, particularly the MNRE, is that the CDM could be instrumental in improving the business case for IPPs (EIWEN 2007) though inefficiencies in the administration need attention. It is also being seen as an instrument whose revenues could be shared to include recalcitrant stakeholders in wind power such as power utilities or local landowners.

As the climate debate intensified in India, and the stance on its role in global mitigation efforts changed (Michaelowa and Michaelowa 2012; Shukla *et al*. 2004) wind was viewed as a sector that could contribute to the national strategy. The 12th National Five Year Plan, particularly, frames a co-benefits assessment framework towards this sector in which carbon reductions feature strongly. It also sets a target of 30 GW for renewable energy capacity additions and proposes that half of this comes from wind power, setting aside 0.7 per cent of the national budget towards this aim. Interestingly enough, while the NAPCC document refers to wind power as a necessary sector in achieving the goal of ensuring that 15 per cent of India's installed capacity is renewable power, it does not advocate a mission approach. In contrast, the 12th Five Year Plan offers the possibility that wind may now require a mission approach. This is an example of the fragmented nature of policymaking in India, and the point to note is that whereas wind energy policy is certainly beginning to see influence from actors in the climate change space, the mechanism for doing so has been quite oblique to the current policy framework.

Energy security and adequacy considerations have been a constant thread running through the establishment and evolution of the wind sector in India. Over time, though, other considerations, particularly industrial development and climate change have also become part of the sectoral narrative, driving policy support for the sector, and the actor mix has diversified significantly, with some changes in influence as new policy elements have been introduced. As illustrated in Section 4, even though an evolution occurred within the solar sector as well, the actor constellations and narratives have evolved differently as compared to the wind sector.

4 Solar power

As highlighted earlier, climate change mitigation action is shaped by a variety of factors. While the political environment, country capacity and other macroeconomic and structural issues play their part, questions of technology maturity, international market conditions as well as strategic imperatives play an important role as well. These factors have a bearing on not only the set of players that participate within the sector, but also on their motivations as well as relative influence. In this regard, the Indian solar sector, with its unique politico-economic roots, international dependencies, climate change mitigation linkages and perceived strategic importance provides a fertile ground for exploring: 'Who shapes climate change action in India'.

4.1 Solar power sector in India – a snapshot of the present

The present policy paradigm for the Indian solar sector comprises a range of policies at the central and state levels. At the central level, these policies are part of a mission-oriented approach in the form of the Jawaharlal Nehru National Solar Mission (JNNSM or simply NSM), which was launched in 2009. Further, stimulated by national-level initiatives and policy interest, among other factors as discussed later in this section, several states like Gujarat, Rajasthan, Punjab, Karnataka and others have also formulated and adopted solar policies, of varying nature and scope – as illustrated in Table S-1, for development of solar energy projects in their respective states.

The NSM has so far primarily relied on a reverse auction[14] (also known as reverse bidding) based on capital rent provision (in the form of feed-in tariffs)[15] to make the solar power cost competitive with conventional coal-based power. Within the policies, however, there are a number of policy elements such as the provision for domestic content requirement, qualifications for the investors, etc. that have undergone an evolution within the past 4–5 years. Further, newer policy provisions such as viability-gap funding (VGF) have also been incorporated as the policy has evolved.[16] This evolution has been shaped by the influence of a range of actors within the sector as is analysed in sections 4.2 and 4.3.

Another major policy push for the solar sector has been through the introduction of solar renewable portfolio obligations (RPOs) by different states (above and beyond the already existing renewable energy RPOs). In principle, this mandates the state utilities in these states to provision a fixed percentage of their electricity from solar power, thus creating a market. Further, entities exceeding their targets set through RPOs are eligible for renewable energy certificates (RECs) that can be traded in the market (and are required by entities that fail to meet their RPO or other carbon emissions/energy usage linked targets). However, this policy has failed to provide much support to solar deployment in India owing to the non-enforcement of solar RPOs by the CERC – leading to a non-existential REC market.

[14] In a reverse auction, the sellers (in this case project developers) compete to obtain business from the buyer (power purchasing entities) and prices will typically decrease as the sellers undercut each other.
[15] Under feed-in tariffs, power generators are paid a cost-based price for the renewable electricity they supply to the grid.
[16] Viability-gap funding entails the government providing capital support to the developer while setting up the plant (up to 30 per cent of the project cost in Phase 2 of the NSM) in lieu of a lower feed-in tariff. This mechanism reduces the long-term capital requirement of the projects.

Table S-1 Overview of solar policies in India as on 1 May 2013

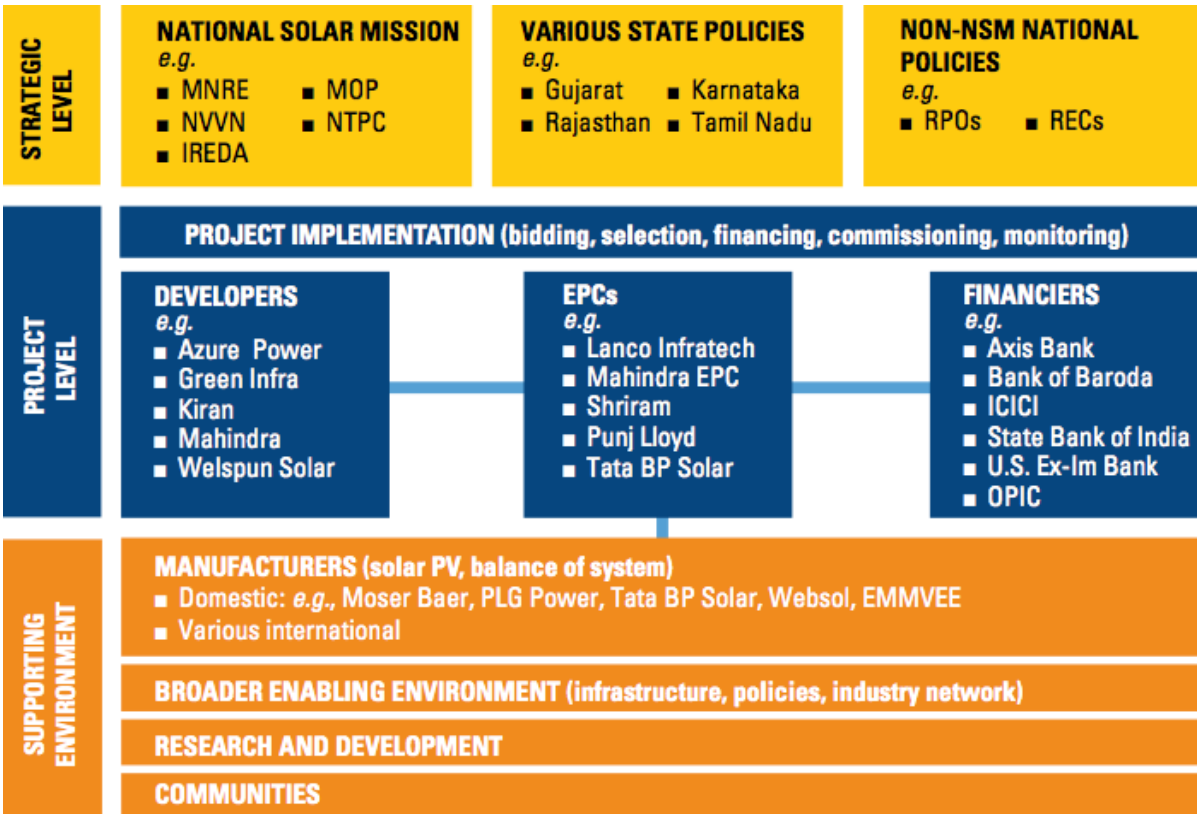
Policy	Target	Off-taker	Financial incentives	Exemptions	Other key benefits	DCR
National Solar Mission (NSM)	20 GW till 2022	Solar Energy Corporation of India (SECI)	Viability Gap Funding (VGF) based on reverse bidding	Will depend on the state in which the project is being executed	Will depend on the state in which the project is being executed	DCR on 350 MW out of the 750 MW to be allocated
Tamil Nadu Solar Policy	3 GW till 2015	Obligated entities (as defined by the state) – state distribution company	Preferential tariff based on reverse bidding (for a part of the target)	No exemption	Single window clearance GBI for residential consumers	None
Uttar Pradesh Solar Policy	500 MW till 2017	State distribution companies	Preferential tariff based on reverse bidding	Exemption on wheeling/ transmission charges	Evacuation infrastructure construction by the state	None
Andhra Pradesh Solar Policy	Not driven by target	Third-party power consumers – Obligated entities	None	Exemption on wheeling/ transmission charges	Banking of power permitted with fee	None
Kamataka Solar Policy	200 MW till 2016	State distribution companies	Preferential tariff based on reverse bidding	Exemption only for policy based projects	None	None
Rajasthan Solar Policy	750 MW till 2017	State distribution companies	Preferential tariff based on reverse bidding	No exemption	Availability of government land at a low lease price Cost of transmission line to be borne by the government	None
Punjab Solar Policy	1 GW till 2022	State distribution companies	Preferential tariff based on reverse bidding	No exemption	Exemption on land stamp duty	None
Madhya Pradesh Solar Policy	800 MW (timeline not provided)	State distribution companies	Preferential tariff based on reverse bidding	No exemption	Solar parks to be created for policy allocations	None
Chhattisgarh	500 MW to 1000 MW by 2017	State distribution companies	Not known	No exemption	Exemption from electricity and stamp duty	None
Gujarat	Target exceeded	State distribution companies	Preferential tariff	No exemption	Solar park infrastructure provided	None

Source: Adapted from Bridge to India (2013).

Within this institutional framework, as shown in Figure S-1, the solar ecosystem in India is characterised by a number of entities, some setting overall policies (ministries such as the MNRE, MoP and bodies such as the NTPC, NVVN, SECI and IREDA),[17] some as project executers (private players such as project developers, EPCs and various financiers) while some provide the supporting environment for solar power development and deployment. Within this support environment, some players such as the manufacturers of solar PV systems have a further segmentation of being domestic or foreign (which colours their perspective on several policy elements) while others such as communities (including NGOs and thinktanks) are responsible for agenda setting and contribute to the policy formulation and deliberation stages.

Within these players, while the institutional actors are motivated by their respective objectives (as detailed previously and within the player profiles in Appendix A), there is also a pervasion of some broad governmental objectives (such as job creation, industrialisation and reducing imports) within their outlook towards the solar sector. Among the private sector players, for the project developers, who bid for projects and, if successful, are primarily responsible for commissioning projects on time, return on investments is the paramount motivation for being in the solar sector. As a result, they seek higher rents, lower solar module prices and cheaper financing within the solar sector ecosystem. That said, even within the developers, while some players have a long-term strategic viewpoint of the solar sector, a large number of players seem to have a short-term rent-seeking perspective towards the sector.

Figure S-1 The solar ecosystem in India with the player groupings according to their role



Source: Adapted from CEEW-NRDC (2012). Note: EPC – Engineering, Procurement and Construction contractors. For abbreviations and selected player profiles please refer to Appendix A.

[17] See Appendix A for profiles.

Players within the EPC and financier categories, although important, are not active participants in the ecosystem as far as influencing the policymaking process is concerned. Interestingly, some of the larger players in the sector fulfil the role of developers, EPCs as well as operators for the projects, thereby gaining operational expertise across the entire downstream supply chain for the solar industry.

Within the manufacturers, the dichotomy between domestic and foreign manufacturers is quite evident in terms of their outlook towards NSM policies – particularly the domestic content sourcing and financing elements. As elaborated later in this section, this contrast in motivations for these two actors has played a significant role in shaping the solar policy within India. Lastly, the NGOs such as TERI and CSE have been critical players in setting the agenda for the introduction of a solar mission within the country (and even more broadly on thinking about climate change mitigation) and have pushed issues of energy security, climate change mitigation, implementation transparency as well as energy access within the policymaking process – albeit with little success on the last issue.

4.2 The emergence and evolution of the solar sector in India

Solar power, over the years, has been touted as the perfect fit solution for a range of Indian power sector problems. Clean, abundant, decentralisation-capable and a nationally self-reliant source of power, solar power assured, in principle, alleviation from chronic power shortages, as well as the strategic handicaps of imported fuel dependence while also promising other socioeconomic advantages. As a result, Indian policy interest in solar energy dates back to the 1980s, with pilot projects materialising at varying scales for over two decades. However, a major impediment to deployment was the very high price of solar power *vis-à-vis* conventional power sources such as coal. During this period, even within the renewables, technologies such as wind power proved to be cheaper than solar implementations. Consequently, despite favourable factor endowments, Indian policymakers did not pursue solar power deployment on any meaningful scale until 2009 even though within policy circles the interest in solar power began to increase with its global emergence as a sunrise industry during the mid-2000s. However, notwithstanding the small scale of deployment, the period prior to 2009 can be divided into a pre-2005 and a 2005–09 period based on the type of policies, policy objectives and nature of involved stakeholders.

During the pre-2005 period, the sector was almost singularly policy-driven, focusing on some academic R&D and small-scale demonstrations, with few small industrial actors. The DNES and later the Ministry of Non-Conventional Energy Sources (MNES) – predecessors of the MNRE – funded several pilot projects that explored solar power applications within India and mostly focused on decentralised, rural installations (Cherail 1992).

The primary motivation for policy interest within this period was the promise of demonstrating a localised, indigenous energy source for a country faced with a large energy deficit as well as huge oil import bills (JSIR 2003). But owing to the lack of a strategic approach by the government and a yet muted industry presence, this period saw neither deployment scale-up nor a domestic industry creation within the solar sector. Further, within the little demonstration that materialised, the states had very little role to play with most of the projects funded by institutions of the central government.

During the mid-2000s, as the international market for solar power boomed, policymakers in India also began to consider the ‘sunrise’ solar sector more seriously as an energy-security and energy-access measure. The deployment-centric policy support for the sector was introduced by the central government with policies such as the Rajiv Gandhi Grameen Vidyutikaran Yojna (RGGVY) focusing on rural deployment of solar energy, thereby creating a market for solar power (Harish and Raghavan 2011).

At the same time, triggered by the increasing global demand, and betting that the domestic market would also follow in the future, some Indian firms such as Moser Baer,[18] Tata BP Solar, etc. also set up large (by Indian standards of the time) manufacturing plants in the country. These firms also developed international knowledge linkages through joint ventures (Tata and BP) as well as acquisitions (Moser Baer acquired several firms outside India during this period) (see Lema and Lema 2012 and Fu and Zhang 2013). While the initial emphasis of these firms was exports (see, for example, Mishra 2009, 2012), eventually some domestic deployment also started materialising.

Following this private sector enthusiasm and owing to an overall policy impetus towards increased industrialisation, a more consolidated policy framework towards a supply push within the sector also started emerging with the semiconductor policy of 2007 that provided incentives and capital subsidies for several application sectors including solar. Under this central government scheme, solar manufacturers could reduce their capital costs for plants by 25 per cent, passing these savings downstream into more competitive products. It is noteworthy that even though private sector investments into manufacturing facilities were happening around this time, little emphasis was placed on systematic research and development, with the Indian firms relying on established technologies from the developed markets for their products.

The sectoral growth in the Indian market, which was triggered by the international market, was also arrested by the global slump in the solar installations following the economic crisis of 2007–08. As the global prices for solar modules plummeted, the Indian manufacturers were stranded with significant unrecovered investments in manufacturing lines that were now operating much below their capacity and products that were uncompetitive compared to other producers' offerings (see Mishra 2009). While some solar installations within the country, driven by MNRE support, were taking place, the globally tightened fiscal situation led to a slowdown within the Indian solar sector.

Over the past 4–5 years, the Government of India together with various state governments has been working towards introducing policies and creating an environment conducive for developing solar power in the country (see Table S-1). The Jawaharlal Nehru National Solar Mission (JNNSM), launched in November 2009, is the largest of such policy initiatives. One of the eight National Missions laid out in India's National Action Plan on Climate Change (NAPCC), the mission was launched with an aim to install 22,000 MW of on- and off-grid solar power using both photovoltaic (PV) and concentrated solar power (CSP)[19] technologies by 2022 as well as a large number of other solar applications such as solar lighting, heating, and solar powered water pumps (with the latter aimed at increasing energy access). Within this, while 20,000 MW are planned through grid-connected installations, the rest (2,000 MW) are envisaged through off-grid applications.[20] As of June 2013, approx. 426 MW of grid-connected solar capacity has been added through the NSM programme (Bridge to India 2013).

A number of reasons led to the introduction of a mission-based policy approach by the Indian government for the solar sector. By the late 2000s, the Indian government was increasingly coming under pressure at various international fora to take steps towards climate change mitigation. Meanwhile, some central government ministries led by the MNRE and the DHI were drawing up plans to boost the solar sector (a seeming extension to the support extended during 2005–08) due to job creation, energy security and industrialisation considerations. Because of these concerns and interests with the chronic energy shortage and import dependence for energy in India, a mission-based push for the solar sector made

[18] Confirmed in interview with former executive at Moser Baer.
[19] CSP technologies rely on heating water (to generate steam) using mirrors to concentrate solar radiation. Projects under CSP have not yet been commercialised in India.
[20] JNNSM Phase II Policy Document, Dec 2012, MNRE, http://mnre.gov.in/file-manager/UserFiles/draft-jnnsmpd-2.pdf.

imminent sense. However, to address the growing international pressure the NSM was packaged and presented primarily as a measure towards reducing India's carbon footprint.

Interestingly, while the mission was projected as originating from climate change mitigation concerns, placing its implementation within the MoP (through NTPC, NVVN, etc.) changed the nature of the policy formulation process. Falling prices of solar panels across the globe further aided the agenda setting for the mission and led to the ambitious target decision. Other than purely government bodies, actors such as the NGOs (both Indian and internationally funded)[21] international institutions such as the World Bank and solar manufacturers (primarily Moser Baer and Tata BP Solar) were instrumental in agenda setting for the mission policies.

That said, the creation of an industry at a national scale requires direction across a number of issues: What deployment areas need to be targeted – grid-connected or off-grid or both? Should the country rely on cheaper imports (at least initially) or should the focus be on the creation of a domestic manufacturing base? What policies are needed to ensure the chosen direction is achieved? Should these policies focus on extending energy access or just increased power availability nationally? To what extent should the country focus on R&D and across what areas? Should the mission be technology agnostic? If no, what and how would technologies be chosen? How does one ensure the flow of capital from the various financing mechanisms to a nascent and costly investment sector? Do subsidies focus on generation or capacity building?

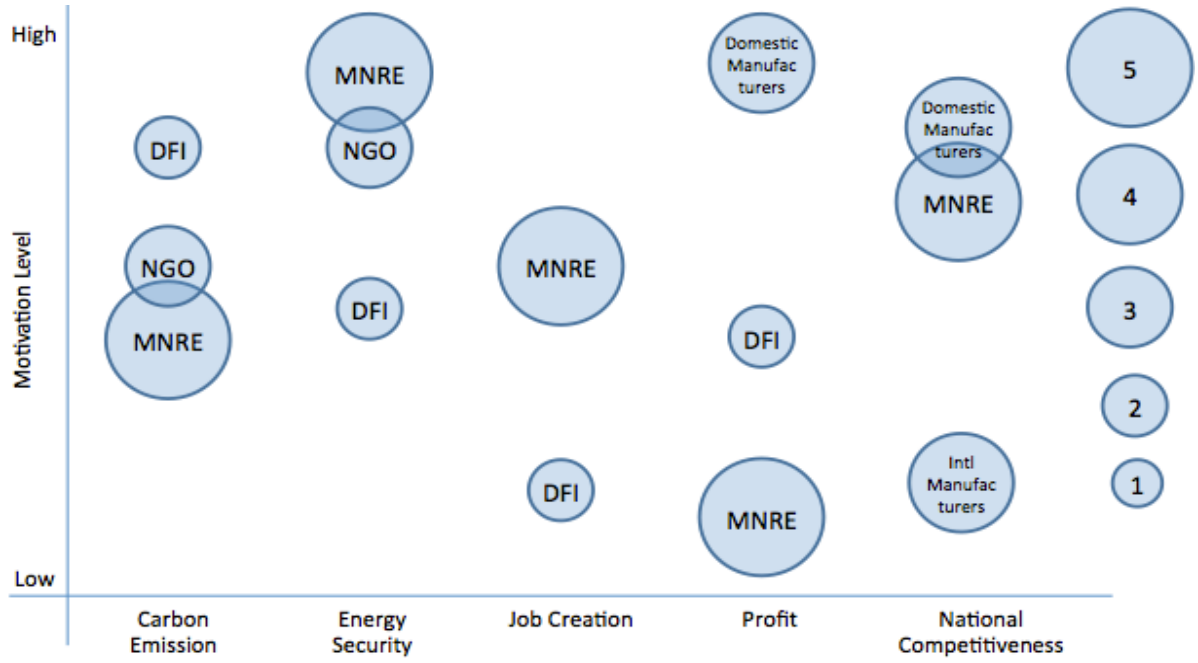
These questions, among many others, were answered, with varying decisiveness, by the Indian government as it set about drafting its initial JNNSM policy in 2008–09. This process involved an agenda-setting phase, initial drafting phase, and a draft deliberation phase. During these phases various actors exercised their influence through available mechanisms to sculpt a policy catering to their motivations *vis-à-vis* the solar mission (see Figure S-2). Actions within these phases and the final policy draft provide a useful cue towards the primary question of this report (who shapes climate action in India). Interestingly, the policy elements within the overall JNNSM framework have themselves evolved over the past 4–5 years (with the most important rehashing happening in the 2013 draft for Phase 2 of JNNSM). This evolution, coupled with the inclination of the involved actors towards these policy elements presents useful insights into the political economy characterising the Indian solar power sector (see Figure S-3).

Accompanying this evolution of the policies, as the sector has grown, the relative influence and the influence mechanisms of the actor groups have also changed. While in 2009, during the formulation of policies for Phase 1 of NSM, manufacturers and NGOs constituted a major influence outside the government (the developers were essentially non-existent in the initial stages), this has changed in 2013. Developers, having gained experience at project implementation and having been involved in the policy deliberations during 2009–13 have grown both in their influence as well as the scope of this influence, which now extends to the agenda-setting phase as well. This increase in the influence of developers is more pronounced at the state level rather than the central level, where concerns around industrialisation (within policy formulation) still favour the Indian manufacturers.

This process of policy and actor influence evolution within the solar sector has been played out around some key narratives (that correspond roughly to the policy elements shown in Figure S-3). In the next section, we examine these narratives from an evolutionary perspective, drawing on the various linkages (actors, motivations and influences) to decipher the political economy.

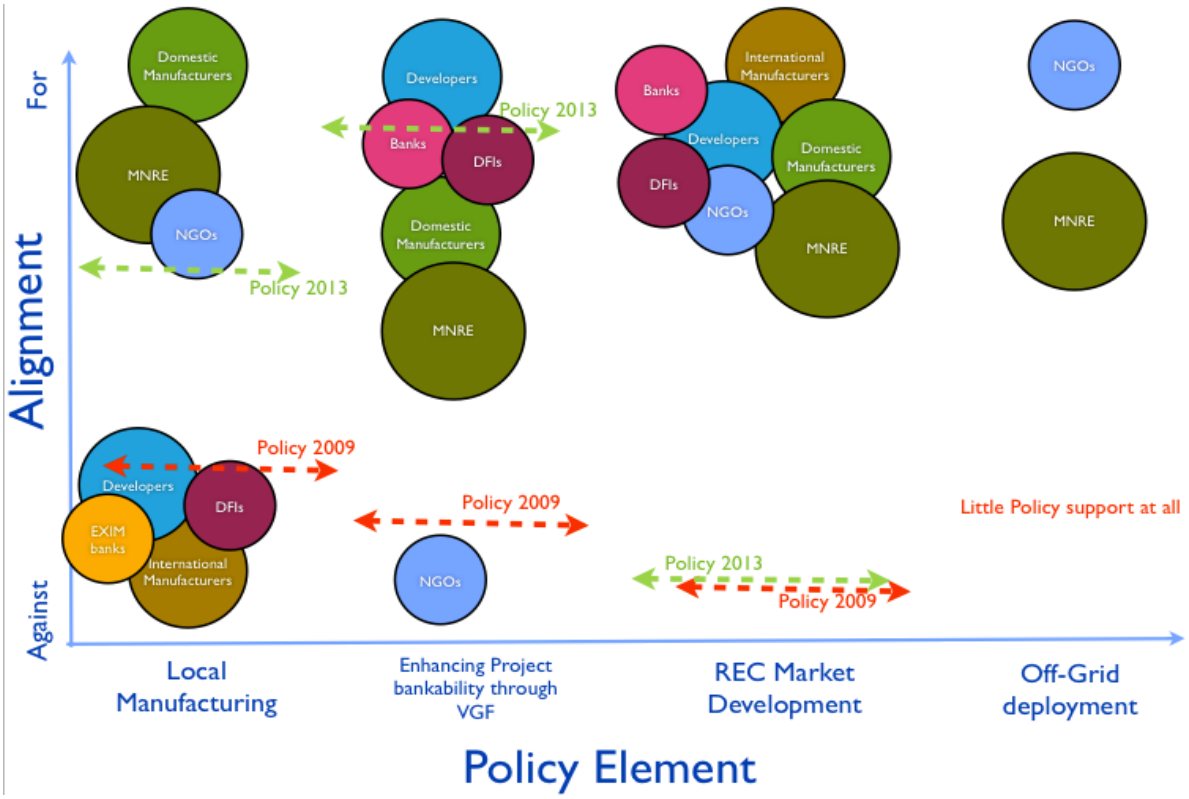
[21] Interestingly, while the focus of Indian NGOs (like CSE and TERI) has been centred on issues of energy security, energy access, domestic manufacturing and industrialisation, some internationally funded NGOs have focused on the climate change mitigation aspect more strongly.

Figure S-2 Stakeholders in the Indian solar sector with their influence and their respective motivations



Source: Figure compiled by authors. Note: bigger circle denotes higher influence. DFIs – Development Finance Institutions.

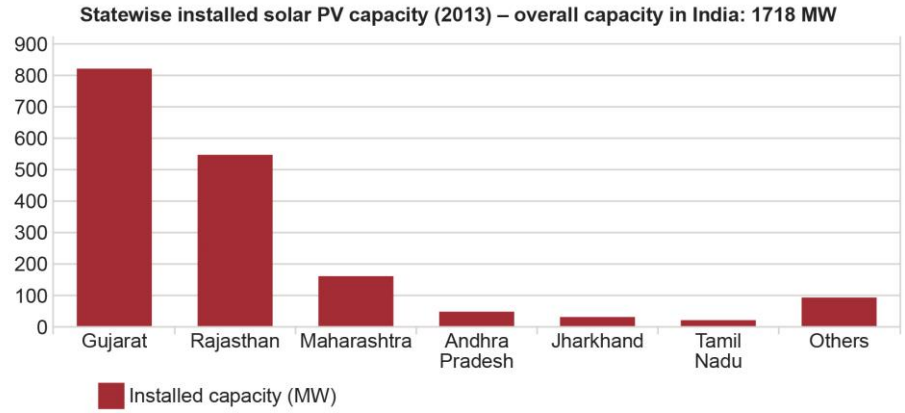
Figure S-3 Interest alignments and inclinations for the various actors within the Indian solar sector over three key policy elements present or missing within the National Solar Mission



Source: Figure compiled by authors. NSM policy documents; insights from key informant interviews.

At the same time, as is evident from Table S-1, while JNNSM has been the primary policy enabler for the solar sector in India, state policies (especially in states such as Gujarat, Rajasthan, etc.) have been key to accelerated deployment within these states. For instance, most of the deployment in Gujarat (which by itself accounts for a majority of solar deployment in India during 2010–12) has leveraged state-level support extensively (see Figure S-4). As a result, it is imperative that we examine the shaping of state policies as well. More so, considering that several motivation factors for the central level policymakers play out differently at the state level (case in point: domestic content requirement, energy security, etc.). Therefore, it is instructive to understand the state-level dimension to solar policies in India, something addressed later in this section.

Figure S-4 Statewise installed Solar PV capacity in 2013



Source: Bridge to India (2013)

4.3 The political economy of the Indian solar sector: key narratives

To better understand the process of sectoral evolution, in this section we have unpacked the overall sector along several key narratives. Each narrative represents an important dimension along which the sector and its attendant policies have evolved, shaped by the motivations and actions of the involved actors, within the context of the broader macroeconomic and international environment. Following an exploration along these specific dimensions, we reconvene at the end of this section to present the key findings for the solar sector in India.

The 'industrialisation through solar' narrative

One of the key drivers of the National Solar Mission was the Indian central policymakers' aspiration to become a major global solar player through the establishment of a domestic solar manufacturing base that not only caters to the domestic market but may also become an exporting industry in future. Solar manufacturing offers India a long-term opportunity to be a major global manufacturing nation, an avenue to achieve grid parity with fossil-fuel power generation, and greater flexibility to achieve a sustainable solar industry. Towards this end, the solar mission was shaped to provide favourable regulatory and incentive conditions to develop domestic manufacturing of affordable solar technologies.

A major policy element for encouraging the emergence of a domestic solar manufacturing industry was the inclusion of a domestic content requirement (DCR). Although the initial Mission Document did not mention a DCR, the subsequent Mission Guidelines for the first phase did include a local content requirement to promote the Mission's goal of creating a solar manufacturing industry. The guidelines required that crystalline silicon modules be

manufactured in India (though not necessarily by Indian companies), a component that forms a significant fraction of the total system costs. This provision, aimed to protect the domestic manufacturers (who lacked both the technological edge and the scale required to compete with American and Chinese firms internationally)[22] was limited to the crystalline silicon technology and was waived for the thin-film based solar cells (since there were very few Indian manufacturers using this technology). The domestic project developers (who were the customers of the solar modules) initially supported the DCR provisions that promised to provide a local supplier base for their projects. However, as the global solar module prices plummeted in 2009, the solar developers could procure much cheaper modules from abroad and have since been proposing to do away with the DCR requirements within the NSM.

Ironically, due to the lack of any DCR on the thin-film based solar modules, India has emerged as the only large solar market with a majority of thin-film based installations. Within the first phase of the NSM, while projects under the NSM utilised thin-film based modules mainly for the US, projects funded through state-led programmes (with no DCR requirement) imported cheaper crystalline silicon modules from China (Ramesh 2013b). This has led to a significant over-production in the domestic crystalline silicon industry due to their higher price compared to available import options. Furthermore, developers have better access to low-cost financing when they import from abroad (due to finance provisioning through the respective country's Ex-Im bank). As a result, within the first phase of the NSM (2009–13) the DCR has failed to provide any significant fillip to domestic solar manufacturing in India (Sahoo and Shrimali 2013).

Promised with lower project costs and better finance availability, the developers have favoured a more relaxed DCR requirement in the NSM Phase 2 (2013–17), in alignment with foreign manufacturers and financing institutions. At the same time, several other stakeholders including domestic manufacturers, NGOs and government institutions sought to correct the shortcomings of Phase 1's DCR provisions and further domestic manufacturing in Phase 2. Finally, as per the recommendations draft for Phase 2, DCR is proposed to include thin-film technologies as well, much to the chagrin of foreign manufacturers. Further to this, there are ongoing deliberations on imposing anti-dumping duties on imports from certain countries, revealing a clear focus on industry protection rather than cheaper deployment.

Two broader issues favour a DCR requirement and are pervasive in their influence across government institutions. One is the need to create a large number of jobs to employ the burgeoning employable population in India.[23] Secondly, the high current account deficit for India mandates that the government favour policies that reduce imports and encourage exports. Given its strategic importance both from an energy security as well as industrialisation perspective, the emergence of a domestic solar manufacturing industry is highly desirable within policymaking circles.

That said, crucial aspects of domestic industry development such as building capacity through R&D have not been focused on, either by policymakers or by the involved stakeholders. So far, policy elements have been aimed at accelerating deployment without much consideration of developing capability and several stakeholders have engaged with a 'rent-seeking' attitude with little strategic investments.

The 'financing' narrative

Within the first phase of the JNNSM, two primary incentives were provisioned for accelerating the deployment of solar power: feed-in tariffs and RPOs. While the feed-in tariffs have worked well in incentivising the setting up of solar capacity, there has been a very limited uptake of the RPO based approach for setting up plants. The primary reason for this

[22] See previous sub-section. See also Mishra (2009) and Mishra (2012).
[23] Even though critics have argued that a significant job creation potential lies within the downstream deployment activities (rather than manufacturing), which would increase if cheaper imports lead to higher deployment numbers (Basu 2011).

has been the hitherto limited market for the RECs and the failure of the regulatory authorities to enforce the RPOs on the designated entities (state electric utilities in this case). While the lack of an REC market ties to the opposition within large industries to a financial cost towards carbon emissions, the lack of RPO enforcement is, among other reasons, due to the poor financial health of the state electricity utilities as well as an apparent lack of willingness to enforce renewable energy targets stringently (see Michaelowa and Michaelowa 2012 for more details). As Figure S-3 clearly illustrates, even though almost all the major actors involved within the solar sectors favour the enforcement of RPOs (leading to an REC market development and thus incentivising solar deployment) policy evolution along this front has been minimal. This is due to larger systemic issues within the Indian power and energy sector that are shaped by lobbies and considerations far stronger than the ones at play within the solar sector.

On the other hand, another perspective on the financing issue presents a different influence mechanism in the sector. During the first phase of the NSM, developers have been able to obtain cheaper financing for the imported thin-film modules through financing mechanisms of the Ex-Im banks in countries of the module's origin. For instance, the US Ex-Im extends very favourable (especially when juxtaposed against the high interest rates in the Indian market) financing terms if the developer sources modules from a US manufacturer. This relationship has led to an alignment of interest among the Indian developers and module manufacturers from specific countries. However, this has further decreased the usage of Indian manufactured modules since projects financed through money raised within India were deemed non-bankable in several cases.

To enhance the bankability of solar power projects in India, the policy recommendations for the second phase of the NSM have focused on providing viability-gap funding (VGF) in addition to other incentives. This step is expected to enhance the feasibility of projects using Indian financing, thereby decreasing dependence on financing from abroad. At the same time, VGF also favours capacity building over power generation, a shift that has led to opposition from NGOs who see this step as diluting the incentive for project developers to choose the best performing technologies for plants.

In essence, a key gap within the NSM has been the lack of a clear financing roadmap (PwC 2012). As technology risk premiums are still quite high, the sector needs a greater systematic engagement of both government provided finance (through IREDA) as well as private sector participation (such as in wind), which is currently lacking. Instruments from international sources such as payment guarantees have only been leveraged to a limited extent (CEEW-NRDC 2012; Nelson *et al*. 2012). In the future, as the financing needs of the solar sector increases and as competition from foreign sources of financing for projects (that have linked component sourcing conditionality) increases, Indian RE policies would need to tackle this issue if a significant scale-up of renewable deployment is to be achieved along with other objectives.

The 'energy security' narrative

India's status as a net energy importer nation has for long motivated policymakers to pursue energy security as a strategic goal. Renewable energy programmes, over the past two decades have been primarily aimed at this motivation. As seen in the wind power section, this energy security consideration predates any discussion on climate change mitigation through renewable deployment. However, within the solar power sector, while energy security considerations have been one of the primary drivers for the mission-based approach, it is the sector's industrialisation potential (with the associated economic growth and job creation possibilities) that has been the more important consideration for policymakers. To quote a former senior bureaucrat at MNRE, 'Even though energy security has been an important motivation for supporting the solar sector, the promise of a self-

sufficient industry catering to the energy needs of the country with a potential of exports later, has been the primary motivation for policymakers.'

However, there are strategic inconsistencies within the energy security narrative, most likely due to the distribution of the non-policy actors. Unlike the German and early Chinese policies the focus of Indian policy has been on large grid-connected plants rather than decentralised off-grid installations, despite analyses that suggest a huge off-grid opportunity within the country (Basu 2011). While initiatives such as the Solar Lantern (*lamp*) programme run by TERI have sought off-grid distribution of solar power, the policy support for such programmes has been limited. This signals at the important role that non-policy actors, especially the private sector, plays in shaping the policy thrust areas – the off-grid sector, with an absence of lobbying from large project developers and EPCs has failed to get enough policy focus and support.[24]

The 'climate change mitigation' narrative

The National Solar Mission, although launched within the ambit of the NAPCC, has not been guided or shaped to a significant degree by climate change mitigation concerns.[25] The twin concerns of industrialisation and energy security have taken centre stage while climate change mitigation has more often been used as a packaging when projecting the NSM at international fora. Interestingly, this is not solely the case with the NSM. Other policies, such as those geared towards energy efficiency that began as a mechanism for energy saving (predating the NAPCC) have seen climate change mitigation being integrated into the accounting system for the programme (and a relabeling into the National Mission for Enhanced Energy Efficiency). So while earlier only the energy saved was used as a metric for programme success, post-NAPCC, carbon emissions mitigated are also reported. All the while, this integration of climate change mitigation as a part of the mission deliverables has not resulted in any significant policy modification from the original programme direction in the pre-NAPCC era. Similarly, within the solar sector, while the NAPCC provided a platform for the launch of the programme as a mission, climate change mitigation concerns have had little impact on the policy formulation within the mission. Instructively, as has been pointed out earlier, while the MoEF is the representative body at UNFCCC leading climate change negotiations, it has had a very limited role to play in the NSM, which has been run primarily by the MoP.

This projection as a climate change mitigation-oriented mission is understood to have provided a demonstrable measure on the part of India *vis-à-vis* its international negotiations position at UNFCCC while also paving pathways for the introduction of better (internationally owned) technologies into the sector through the climate change mitigation route, perhaps in the future (see: www.financialexpress.com/news/national-solar-mission-to-be-finalised-soon-saran/431843).

State-level policies

In addition to the National Solar Mission, state-level programmes have also created an impact on the landscape of solar power in India. As illustrated in Table S-1 and Figure S-4, while the central-level policy (NSM) provides the broad framework for the solar project support, state-level policies are crucial in providing the implementation framework for the projects. Some states such as Gujarat have been more aggressive in supporting solar power and have offered even higher plant feed-in tariffs than the NSM (CEEW-NRDC 2012). Further, state-level policies are mostly aimed at encouraging deployment rather than

[24] Several issues bog down the off-grid solar sector – higher system costs due to lack of scaling opportunities within the existing delivery design of the off-grid solar policy, absence of policy enforced common technical standards (resulting in a fragmented market), etc. As a result, the off-grid solar sector, at present, does not offer attractive investment opportunities for private sector players (compared to the grid connected solar sector). See Shrimali and Rohra (2012).
[25] Interview with senior ex-bureaucrat from MNRE (November 2012).

focusing on manufacturing. This policy structure favours the local state-level developers who constitute a powerful lobby within their respective states, unlike the domestic manufacturers who find more traction within central policymaking.

While power provision and job creation are important motivations for state policymakers to engage with the solar power sector, there are other unexpected factors at play as well. For instance, the lower turnaround times of solar power projects (typically 18 months) compared to coal power plants (~60 months) or nuclear power plants (~240 months), makes them more attractive to policymakers looking to demonstrate the utility of their actions within their electoral terms (~60 months in India). For instance, for a state government it is preferable that the result of its power policies (including support for solar) is visible to their constituents (in the form of increased electricity access and availability) before the next elections – this makes solar power attractive for policymakers. Further, as demonstrated in the case of Gujarat solar policies (and the resultant success at deployment) were used both as a public relations exercise at good, forward-looking governance as well as leveraged within the rivalry with the central government (the political party in power in Gujarat is the main opposition party at the Centre).[26] This case aptly demonstrates how climate action at the state level is sometimes shaped by incidental political configurations and personal ambitions rather than a concerted top-down target-led approach driven by the central government.

Who holds the reins?

At present, solar power is a nascent technology competing against well-entrenched incumbent technologies such as coal power. With the cost of solar power generation yet to achieve grid parity for profitable ventures, the sector is reliant on policy support for its sustenance and growth. As a result, it is the policy direction that majorly determines the course of the sector, and by extension its climate change mitigation contribution. Of course, there are other factors such as private sector investments (strategic purposes), international support for projects as well as civil society led programmes that also contribute to shape the course of the sector.

One thing is conspicuous in both sets of policies and deployment so far – as such, in solar (especially solar PV), the focus on innovation has not yet gathered pace, and this can be attributed to a still immature market, further behind on the experience curve. So far, firms have focused on finding the right mix of business models and access to resources; however, with some consolidation now taking place, firms have begun to leverage local capabilities to innovate along the lines of technology. For instance firms such as Sunborne Energy, a solar energy firm established with venture capital backing and looking to leverage affordable technology solutions that use an increasingly indigenous supply chain, point to the emergence of entrepreneurial ventures in conjunction with large investments by established project developers in the Indian power and infrastructure sector.[27]

As demonstrated within this section, the Indian solar sector is witnessing a period of rent-facilitated growth, with some players investing for long-term growth. Within this period, policymakers are playing the most important role with the primary aims of industrialisation, job creation and energy security. Climate change motivation is acting more as a packaging device – a perpetration of climate change negotiators within the government – rather than shaping the actual policy course. Among other actors, the interplay between the developers and manufacturers (fractured along domestic and international lines) is playing an important role in shaping elements of solar policy. Further, while the solar sector is dependent on domestic and state-level policy support for deployment, the global outlook towards climate change mitigation strongly impacts the interest and investments within the sector. Moreover,

[26] Interview with senior ex-bureaucrat from MNRE and senior official at World Bank (November 2012).
[27] Interview with senior official at Sunborne Energy (December 2012).

the Indian solar sector is still dependent on the global linkages for materials, finance as well as furthering of R&D within solar technology.

Interestingly, the role of financial bodies such as the ADB, IFC and institutional investors has been limited to being fringe players, responding through investments and borrowing rate modulation rather than participating actively in policy sculpting. Civil society and NGOs, although instrumental in the initial agenda-setting phase, have had limited traction in shaping policy in the later stages, a fate shared by the climate change negotiators as well. Of course, as one looks at the macroeconomic and institutional framework within which the solar sector is embedded, factors such as the lack of a market for RECs as well as the limits to government capital support become apparent as crucial structural considerations.

In the conclusion, drawing on insights from the Indian wind and solar sector, we look at some key lessons around the political economy of policymaking within these climate-relevant sectors.

Box 1 Off-grid renewable energy in India: a snapshot

Overview

On indicators of energy access, India's current situation is certainly poor. The Sustainable Energy for All Initiative shows that in 2010, up to 300 million people still lacked access to modern energy services and that only 14 per cent of the population had access to non-solid cooking fuel (SE4ALL 2013). What is disconcerting is that these numbers are marginal improvements to the situation in the past and clearly, there remain significant challenges in the sector (see Krishnaswamy 2010; Palit and Chaurey 2011; Kemmler 2007). Renewable energy in its off-grid avatar has primarily been talked about as an answer to the energy access situation, particularly in the context of rural applications, and to some extent for the urban poor and for powering infrastructure. Despite this, the policy focus has been less than strong (see Rehman and Bhandari 2002).

Whereas expansion of the grid has been the primary approach towards expanding energy access, decentralised units have also had a role to play given the technical difficulties in accessing remote areas. Of the two areas under consideration in this paper – wind and solar power, the former has seen little traction in small-scale applications. The deployment of these technologies is aided by the MNRE, under its Remote Village Electrification Programme (2001) and Village Energy Security Programme (2004). Of these, the growth of off-grid wind systems is primarily linked with the Green Revolution and finds applications in powering pump sets for irrigation, hybrid systems and small-scale farm applications. The MNRE indicates that a total of 1.6 MW is installed across the country in such systems.

Solar power has received greater attention from an off-grid perspective. Notably, the JNNSM has a large component for encouraging off-grid deployment of PV and reflector based heating, cooking, lighting and rooftop power systems – although the focus is on the *number* of systems deployed rather than on creating scalable models of deployment. It sets a target of 2 GW of deployment in such applications until 2022. Projects such as TERI's Light a Billion Lives, and the UN's Sustainable Energy for All Lighting Asia programme are other ambitious initiatives that act in parallel. There is also an increasing focus from private sector participants adopting a 'social enterprise' model to build awareness, design and disseminate appropriate technology while engaging with other stakeholders to develop the ecosystem.

The actor mix

There is a great degree of fragmentation in this sector with a number of dissemination projects with NGOs (such as TERI, the Vasudha Foundation, Ramakrishna Mission, Barefoot College and Milaap) acting to train village entrepreneurs and acting in product design. Bilateral agencies also fund and provide technical assistance for such initiatives and also work directly with the MNRE and MoP in rural electrification, a notable example being USAID which seeded the Rural Electrification Corporation, a financing body.

The private sector is extremely distributed in its participation and there exists no one organisation with considerable scale across the country. Notable examples of private sector players engaged with off-grid solar include SELCO, OMC Power, Simpa Networks and D. Light which all differ greatly in their business models and innovation capabilities. However, even these organisations are growing slowly with constraints in supply chain growth, extension of services, access to finance, stakeholder engagement, etc.

The case of wind power is more straightforward – there exist 12 manufacturers across the country who supply systems (this includes a notable research and community development organisation, Auroville). Financial assistance for installation and purchase is provided directly by the MNRE. A few public and private banks also engage by providing finance for individual customers as well as entrepreneurs.

Incubation support and environments are provided by multilateral agencies such as the World Bank and the Asian Development Bank, and their role in encouraging private sector participation has increased in recent years (a review of their programmes reveals the dominance of solar power systems). Their work includes setting up certification systems, financing, technical assistance and providing platforms for building linkages with other actors (for a brief history, see Martinot *et al*. 2002).

Policy influence

Immediately evident when looking at the policy framework is the piecemeal nature of policies and efforts targeting off-grid renewable energy, despite an attempt at inculcating them into an overarching framework through the Rural Electrification Policy.

Secondly, the lack of aggregation of private sector participants is quite notable. Whereas utility-scale counterparts in renewable energy are well organised, interact regularly with policymaking bodies and take collective action for their sector, organisation and networks are poorly developed in the off-grid sector. However, experts from respected bodies such as SELCO and TERI play a significant role in consultation dialogues and in highlighting sectorial issues for policymakers.

Multilateral and bilateral organisations, while playing a significant role in capacity building, both at the grassroots level as well as at the regulatory level, still have little *direct* influence on policymaking, but continue to shape the sector significantly through direct engagement and investment. NGOs, similarly, provide valuable platforms but their engagement at times is directly with consumers, manufacturers and entrepreneurs, bypassing policymakers.

In essence, the development of off-grid renewable energy policy in India has not seen the level of political engagement or will to engage as the grid-connected component. Some explanation is found in the fragmented nature of the sector, the distributed operations and lack of networks among stakeholders.

5 Conclusions

This paper has endeavoured to develop a better understanding of the key actors and priorities shaping climate mitigation action in India by drawing on two case studies in the renewable energy sector, wind and solar. The cases discussed above serve to highlight the centrality of domestic policies in India for shaping action within two climate-relevant sectors. Further, despite the seeming integration of the 'climate change mitigation commitment' motivation within the policy frameworks, there is ample evidence of 'bottom-up' factors influencing these sectors. Further, as proposed by Abbott (2011), the role played by non-public actors and networks shows that these bottom-up efforts are being contributed to and/or driven by international actors as well. Interestingly, while the strong domestic imperatives manifest strongly in sectoral policymaking, international influences through technology availability, import dependence for system components as well as financing are also apparent. Thus, adding to the existing literature on the emerging governance paradigms for climate change action, from our observations of these sectors, we contend that to the extent there may be multiple regimes operating in the climate space, cross-cutting factors – in the form of technology, financing, and TNCs – provide some linkages across these regimes. That said, it is also quite clear that significant barriers of technology, financing and capabilities remain as before, despite development imperatives and present climate change motivations, for these regimes to start working synergistically or coalescing sufficiently to address the climate challenge. How these barriers may best be overcome or whether, by overcoming them, effective climate action can emerge, are questions that remain unanswered.

For the Indian wind and solar sectors, most broadly and not unexpectedly, given that these are areas where the market is unable to take technologies forward by itself due to their higher cost compared to conventional alternatives, public policy actors play the most crucial role. At the same time, however, three other categories of actors are also relevant: firms, especially project developers; civil society actors and NGOs (domestic and international); and negotiators in the global climate arena that are shaping the broader context in which climate actions are contemplated and advanced. As indicated earlier, obviously, the roles of these different players take on different weights and dimensions in the two sectors presented and have also evolved over time.

5.1 Shifting priorities

First and foremost, the driving force behind policy in both sectors has been a combination of factors including energy security (and access), industrial development, and more recently, climate change. Energy security and adequacy, while being the primary policy focus in the 1990s, and still remaining a part of the priorities for the two studied sectors, is now accompanied by industrialisation imperatives (linked to development concerns) as well as the integration of climate change mitigation concerns, as part of the policy focus.

As highlighted earlier, the focus on solar power was not just a signal of intent on climate mitigation, but was also driven by an understanding of the importance of this industrial sector; wind power gained prominence as a viable captive generation option while moving towards grid parity. It is instructive to note that so far both sectors have been promoted by the MNRE (and MoP), whose institutional imperative is greater deployment of energy technologies and not by the MoEF, which is the nodal ministry for climate change within the country. As highlighted earlier, while industrialisation and competitiveness concerns are more active within the solar sector, concerns of energy adequacy (especially for captive power generation) are still strong drivers for the wind sector. Interestingly, sectors that provide more strategic depth from the industrialisation or economic development point of view (such as

solar) are now being more aggressively pursued compared to other sectors (such as wind) that gratify primarily along the energy security and adequacy dimension.

The evolving policy narrative and the shifting priorities in these sectors highlights development imperatives as the key drivers, with climate mitigation being presented as the 'co-benefit', although this linkage is useful in both exploring mitigation options in the country as well as responding to the international landscape of climate change negotiations. This 'development priorities first' rationale has become increasingly instrumental in securing stakeholder buy-in and has now become central in shaping policy. A comparison across sectors (such as energy efficiency and mobility) also supports this perspective.

5.2 The mix of actors and motivations

Over the past few years, the discussion on climate change in India has shifted from the exclusive purview of negotiators and central-level bureaucrats to a broader debate involving business, state bureaucrats and civil society with the discussion shifting towards how to balance climate mitigation with developmental aspirations. At the same time, within the more specific renewable energy discussion, the focus of central government has moved from an energy security and adequacy agenda to a combination of the industrialisation perspective, climate change mitigation as well as energy security concerns. Consequently, businesses have moved in to seek rents (from initial subsidy driven deployment regimes) as well as build competitiveness in green transformation opportunities for the future. Multilateral and bilateral agencies have mostly been involved in the agenda setting, policy formulation, and early implementation stages, often lubricating (and even shaping) the process through advisory inputs as well as strategic grants. Overall, therefore, a much wider variety and number of actors has become involved in the process of shaping India's climate change action.

In specific cases such as that of project developers in the solar sector, players that were almost absent as stakeholders during the formulation of the initial draft of the policy, have now emerged as strong actors involved in policy shaping as evidenced in the recent solar policy draft. Furthermore, their position on specific issues such as domestic content requirement while shifting over the past few years has also impacted policymaking. This evolution at multiple levels dynamic only goes to serve that as renewables have grown in size (installations each year), so have economic interests, prompting larger businesses to invest within an area supported by capital subsidies or other support mechanisms. Meanwhile, the response of the policymakers has focused on trying to determine the minimum rents that would encourage investments within nascent sectors. The reverse-bidding mechanism within NSM and withdrawal of generation and installation benefits within wind illustrate this intent. Indeed, the success of reverse auctions in driving down prices in the first phase of the NSM has prompted some policymakers at the state level in Rajasthan to propose similar measures for wind. This was opposed vehemently on the grounds of lack of clarity about critical elements such as infrastructure and long-term policy clarity, and has not materialised thus far.

While central policies have been important in shaping the Indian RE landscape, the role of state-level policies has become increasingly important. With the state-level implementation details such as the exact feed-in tariff for wind power projects, wheeling charges for RE projects, RPO targets, etc. being finalised at the state level, state-level policies influence the relative investment attractiveness for developers in a particular state and sector. Within the states, the developers seem to have expanded their influence compared to the equation at the central (federal) level, perhaps a manifestation of the local political lobbying power of the developer companies.

It is also instructive to note that policy motivations towards renewables at the state level and the central level are not always similarly vectored. While much emphasis is placed on industrialisation and competitiveness concerns surrounding climate change mitigation (and

renewables) the primary focus within states seems to be energy security and job creation (through deployment).

5.3 Seemingly unopposed: the indirect hindrance to renewables

Unlike some developed nations, where the growth in energy demand is relatively low and renewables supply a significant proportion of the power mix, the situation in India is of a market where supply trails demand and renewables are still a minor fraction of the power mix. Consequently, while in developed countries, the conventional power generation industry is directly competing with the renewables industry, in India there is still plenty of room for both to grow. While the other power sources such as coal do compete indirectly with renewables by vying through public finances (for coal through subsidised fuel and for renewables through support incentives), as such, the question of an opposing lobby for renewables is different from that in most developed nations.

To add another layer of complexity to the political economy, while large energy users such as large industries are not directly impacting the renewables sector, they do exhibit indirect influences on the sector. These large energy users have been influential players in a political economy characterising the dysfunctional REC market in India. A strong functioning REC market, on the other hand, could have played a catalysing role within the renewables sector, leading to enhanced deployment within the country. This layer is also directly linked with institutional stakeholders such as the state electricity boards and utilities that also create opposition on the grounds that the REC mechanism yields little *real* benefit for them without transfer of electricity and positive incentives for compliance (instead of regulatory penalties, which are, in any case, poorly enforced).

5.4 The emergence of long-term strategies?

Based on observations of both sectors, their developments over time and of the actor-motivation mix, some contrasts emerge with respect to the position of both wind and solar in national strategy. Wind power offers rich facets of evidence of ‘bottom-up’ factors driving policy change and significant pressures for long-term policy stability and clarity. Organisational actors and public actors all recognise the importance of wind power, but this has not yet resulted in a stable, coherent, high-level strategy that integrates climate, development, energy and other imperatives. While some institutional agents act as brokers and ‘champions’ of the sector, playing a critical role, long-term commitment from the highest echelons of policymakers to wind power as a potential instrument of mitigation is yet forthcoming.

Solar power, on the other hand, exhibiting a ‘top-down’ diffusion of policy and integrating a wider variety of interests (domestic and international), has a clearer [stated] strategy and objective and institutional/political commitment. In terms of the policymaking and implementation system, the National Solar Mission is a significant breakaway from any previous endeavours, and is leading the way for state-level policies. Despite the sophisticated federal government approach to solar, however, it remains a fairly nascent sector, with the policymaking dynamic likely to evolve in complexity, and where new linkages may emerge. In that respect, it remains to be seen how, in the face of the complexity, the long-term strategy and commitment plays out.

Notwithstanding an evaluation of the efficacy and contributions of both sectors in climate mitigation, they form a microcosm of the wider political economy conditions in which climate action takes place. What emerges is that it is too early to say whether national-level climate action accommodates the diverse policy imperatives and political pressures to a strategy that is credible both internationally, in line with the development agenda and palatable to domestic stakeholders. Further research is needed across other sectors relevant to mitigation action, to find out if the co-benefits and bottom-up approaches can provide insights

as to why there has been relative inaction in areas which are arguably, more relevant to the development agenda as well as in terms of potential climate impact (for example, decentralised energy and home cooking).

5.5 Some implications for global negotiations

As has been highlighted above, and not surprisingly, climate action in the wind and solar power sectors is not solely driven by climate change mitigation concerns. Other co-benefits such as industrialisation and energy availability play a critical role albeit to differing degrees across these two sectors.

This finding, in conjunction with the present global discourse on sustainability-focused action, which is dominated by concerns of climate change, presents an interesting issue. While reducing carbon emissions and mitigating climate change is indeed the central global public interest, we need to recognise that national-level progress is driven by interests that prioritise energy security and economic development, more so within developing countries. These additional layers of complexity, while ostensibly making the road to a global governance of the climate problem that much more difficult, are an indispensable dimension of the problem and its solution.

From a developing country perspective, one also needs to understand that the primary question is not whether there are climate change mitigation activities but rather whether the present pace of activities, driven by the present concern-motivation-capability mix, is indeed sufficient. With a wide consensus on the answer to this question being no, it is critical that we expedite this pace. This paper has focused mostly on what is happening in the domain of national policymaking in the absence of international agreements – this narrow focus may shed light on how to enhance mitigation activities somewhat but it is unlikely that a quantum transformation, which seems to be required to meet the ever more urgent and uphill task of addressing the climate challenge, will emerge through these regimes. Our observations in this paper also do not point to any significant synergies emerging between climate considerations and development imperatives that would greatly accelerate the climate-compatible transformation. What is clear is that development of policy capacity at multiple levels (central government, state government) to navigate the thicket of issues – the multiplicity of policy objectives, stakeholder perspectives and interests, the relevance of policy options for the local context – will be key to effective implementation of climate mitigation efforts. Emerging international institutions such as the Climate Technology Centre and Network under the UNFCCC could play an important role here, with a clear focus on strengthening local capabilities for long-term management of this transformation.

Considering the nature of the climate action governance that has emerged globally and given that a renewed climate convention (or deal) involving all countries may materialise in 2015, there is a high likelihood of an increased engagement from developing countries. Hopefully this engagement would occur within a cooperation regime that sufficiently addresses questions of accountability, equity and capacity. However, as this transpires, there are two challenges that would need policymakers' attention:

- How to manage the tensions (perceived or real) between climate action and development;
- How to significantly enhance the pace and effectiveness of climate action.

As highlighted by the complex interplay of players (and their motivations) that play a role in shaping climate action in developing countries such as India, the process of addressing these challenges would not be trivial. This process would require increased capacity building efforts and cooperation among Annex 1 and Non-Annex 1 countries as well as a reconciliation of the varied motivations of the involved principal stakeholders' motivations. The real challenge for policymakers would be to ensure that climate action across countries,

while addressing the concerns of the stakeholders to a reasonable degree, is governed by the higher principles of public interest, a ripe ground for further policy exploration. Further, on an ending note, while it is not clear what governance structure would characterise climate change mitigation efforts in the future, what is abundantly clear is that present efforts (whether driven by a top-down or bottom-up approach, or something in-between) are, as the latest IPCC report indicates, insufficient and 'far greater *global* efforts are needed to tackle the issue' (authors' emphasis added).[28]

[28] BBC, Jan 2014: www.bbc.co.uk/news/science-environment-25771601.

Appendix A

Ministry of New and Renewable Energy, Government of India (MNRE)

Type: Ministry

Purview: Renewable energy sources

After the oil crisis in the 1970s, the need for energy security led to research and development in alternative energy sources. The responsibility for this task was given to the Department of Non-Conventional Energy Sources in 1982, under the Ministry of Energy. As the importance of renewable energy sources grew, as did the need for proper regulation and laws with regard to it. This led to the formation of the Ministry of Non-Conventional Energy Sources in 1992. In 2006, this ministry was renamed the Ministry of New and Renewable Energy.

This ministry is the nodal agency for all matters regarding renewable energy. Its broad aim is to develop and commercialise new and renewable energy to supplement India's growing energy demand.

Ministry of Power, Government of India (MoP)

Type: Ministry

Purview: Power and electricity management

The MoP was formed in 1992, after restructuring of the erstwhile Ministry of Energy. In 2001, the ministry became the nodal agency for implementation of the Energy Conservation Act, following which in 2003, it became the nodal agency for implementation of the Electricity Act, thus responsible for development, administration and regulation of generation, transmission and distribution of electricity (particularly from thermal and hydro power plants, as renewable energy sources came under the purview of the Ministry of New and Renewable Energy.

Ministry of Finance, Government of India (MoF)

Type: Ministry

Purview: Financial planning, budget allocation, taxation

The Ministry of Finance is involved, among its other regular functions, in budgeting for and financing renewable energy development within the country. As a result, the finance ministry plays an important stakeholder role within the various renewable energy related schemes.

Central Electricity Authority (CEA)

Type: Statutory body under ministry

Purview: Electricity regulation and development

The Central Electricity Authority was institutionalised by the Electricity Act in 2003. It is responsible for advising the government on all matters relating to the country's electricity policy, formulation of short and long-term plans for the electricity sector, coordination of activities to ensure cooperation among the players in the electricity sector, and maintenance of electricity supply to all consumers. In addition, it has also been mandated to specify technical and safety standards for construction, operation and maintenance of electrical lines and power plants. It must also maintain standards for grid operation, installation of meters, and promote measures to improve the technical and human resources of the electricity sector.

Central Electricity Regulatory Commission (CERC)

Type: Regulatory body under ministry

Purview: Electricity tariff and distribution regulation

The Central Electricity Regulatory Commission was also institutionalised by the Electricity Act of 2003. Its primary responsibilities include regulation of electricity tariff, ensuring fair inter-state transmission of electricity, issuing licences for generation, transmission and distribution companies, and enabling information access to all stakeholders.

It must also implement the recommendations of the CEA with regard to maintenance of grid and transmission lines standards. In addition, it must enforce cooperation among all players in the electricity market. It is also responsible for coordination and cooperation among all state regulation bodies to ensure fair inter-state transmission and distribution of electricity.

State Electricity Regulatory Commission (SERC)

Type: Nodal agencies under ministry (at state level)

Purview: Electricity tariff and distribution regulation

The State Electricity Regulatory Commissions are responsible for enactment of the national energy policies at the state level. They assess the needs of state and regulate electricity tariffs, subsidy and incentive schemes and tax benefits for the various state-level actors of the energy sector. They are also responsible for enforcing the renewable purchase obligations of the industries in the state.

State-Level Renewable Energy Development Agencies

Type: Nodal agencies under state governments

Purview: Linking government with manufacturers and developers of RE projects, monitoring and regulating RE projects within states

Indian Renewable Energy Development Agency (IREDA)

Type: Financial body under ministry

Purview: Renewable energy sources

IREDA was established on 11 March, 1987 as a public limited government company under the Companies Act, 1956 and it promotes, develops and extends financial assistance for renewable energy and energy efficiency/conservation projects.

IREDA has been notified as a 'Public Financial Institution' under Section 4 'A' of the Companies Act, 1956 and registered as a Non-Banking Financial Company (NFBC) with the Reserve Bank of India (RBI). IREDA's mission is to 'be a pioneering, participant friendly and competitive institution for financing and promoting self-sustaining investment in energy generation from Renewable Sources, Energy Efficiency and Environmental Technologies for sustainable development.'

Planning Commission, Government of India

Type: Composite body under the Prime Minister's Office

Purview: Strategic planning of India's growth profile

India's Planning Commission was set up in 1950 as an independent body responsible for assessing the nation's resources and planning its development in the most efficient and effective manner. The commission is responsible for the development of India's 'five-year plans', which have been the cornerstone to India's social and economic growth. In addition to the five-year plans, the commission also formulates annual plans, state plans, monitoring plan programmes, projects and schemes.

The Planning Commission has regularly constituted expert committees to assess India's energy scenario and recommend steps to overcome the challenges faced by the sector. The Integrated Energy Policy was the latest report of the Planning Commission's expert committee on energy.

Prime Minister's Council on Climate Change

Type: Expert body under the Prime Minister's Office

Purview: Renewable energy sources

The PM's Council on Climate Change was established in 2007 to harmonise the central government's strategy and activities relating to climate change. Their key tasks include formulation of action plans for assessment, mitigation and adaptation to climate change and to monitor policy decisions to maintain a coordinated national effort in dealing with issues on climate change. This council released the NAPCC outlining the areas where efforts must be made to build resilience against climate change impacts.

NTPC Vidyut Vyapar Nigam (NVVN)

Type: Central government PSU

Purview: Power trading/nodal agency for procuring solar power (before March 2013)

To facilitate grid-connected solar power generation in the first phase, a mechanism of 'bundling' relatively expensive solar power with power from the unallocated quota of the MoP generated at NTPC coal-based stations, which is relatively cheaper, has been proposed by the National Solar Mission. This 'bundled power' would be sold to the Distribution Utilities at Central Electricity Regulatory Commission (CERC) determined prices.

The Mission also provides for NTPC's Vidyut Vyapar Nigam Ltd or NVVN to be the designated nodal agency for procuring solar power by entering into a Power Purchase Agreement (PPA) with solar power generation project developers who will be setting up solar projects before March 2013 and are connected to the grid at a voltage level of 33 kV and above. For each MW of installed capacity of solar power for which a PPA is signed by NVVN, the MoP shall allocate to NVVN an equivalent amount of MW capacity from the unallocated quota of NTPC coal-based stations and NVVN will supply this 'bundled' power to the distribution utilities.

Solar Energy Corporation of India (SECI)

Type: Central government-controlled institution

Purview: To plan and execute an integrated programme for development and deployment of solar energy technologies

The recently established SECI was created to serve as the executive arm of the NSM. The allocation process for projects, signing of PPAs and disbursement of VGF will all be coordinated by the SECI. The SECI would gradually take over all the functions of the NVVN and also channel funds through international agencies with an aim to reduce fragmentation within the Indian solar institutions.

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